



**Ministry of Environment**

# **Development and Implementation of Standards and Labelling Programme in the Maldives**

**Promoting Energy Efficient Buildings through  
Strengthening Low Carbon Energy  
Island Strategies (LCEI) Project**





Ministry of Environment

Strengthening Low Carbon  
Energy Island Strategies (LCEI)  
Project



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*Inception Report– Task 1*

Strengthening Low Carbon  
Energy Island Strategies (LCEI) Project



# List of abbreviations

AC	Air conditioner
AOSIQ	General Administration of Quality Supervision, Inspection and Quarantine
BEE	Bureau of Energy Efficiency, India
BTU	British thermal unit
°C	degrees Celcius
CAGR	Compound annual growth rate
CEC	Comparative Energy Consumption
CFC	Chlorofluorocarbon
CLASP	Collaborative Labeling and Appliance Standards Program
CSEC	Cooling Seasonal Energy Consumption
CSPF	Cooling Seasonal Performance Factor
CSTL	Cooling Seasonal Total Load
dB	decibel
EE	Energy Efficiency
EER	Energy Efficiency Ratio
EGAT	Electricity Generating Authority of Thailand
ESCO	Energy Service Company
FY	Financial year
GHG	Greenhouse Gas
GWP	Global Warming Potential
Hz	Hertz
I	Energy Consumption Index
IEC	International Electrotechnical Commission
IS	Indian Standard
ISEER	Indian Seasonal Energy Efficiency Ratio
ISO	International Organization for Standardization
JICA	Japan International Cooperation Agency
JIS	Japanese Industrial Standards
kCal	kilocalorie
kWh	kilowatt hour
L	litre
LCEI	Strengthening Low Carbon Energy Island Strategies
M&V	Monitoring & Verification
MEA	Maldives Energy Authority
MEE	Ministry of Environment and Energy
MEELS	Mandatory Energy Efficiency Labelling Scheme, Hong Kong
MEPS	Minimum Energy Performance Standard

MS	Malaysian Standard
MV&E	Monitoring, Verification & Enforcement
MVR	Maldives Rufiya
NDRC	National Development and Reform Commission
ODP	Ozone Depletion Potential
PAEC	Projected Annual Energy Consumption
PMU	Project Management Unit
PwC	PricewaterhouseCoopers Private Limited, India
RMC	Remaining Moisture Content
S&L	Standards & Labelling
SOP	Standard Operating Procedures
SRB	Star Rating Band
STELCO	State Electricity Company, Maldives
TIS	Thai International Standard
TV	Television
UAE.S	UAE Standard
V	Volts

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# 1. Introduction

## 1.1. Energy scenario in the Maldives

Energy consumption in the Maldives is increasing steadily on the backdrop of rising demand for electricity and transport sectors – the two main drivers for energy in the country. The power generation is almost entirely dependent on diesel-based fuel generators, as country-wide electrical grid systems are not feasible. The Maldives has no known indigenous petroleum, gas, or coal resources; and hydropower is not feasible because of the topography. Consequently, with total dependence on imports for power generation, petroleum-based fuels are a major import in the Maldives. In fact, the Maldives spent approximately \$239 million on oil imports in 2016<sup>1</sup>, of which fuel imports for electricity generation are the largest contributor.

The government indicates that dependency on imported fuels has worsened since the early 1990s. During the last five years the imports of Maldives have increased at an annualized rate of 12.4%, from \$1.52 billion in 2011 to \$2.12 billion in 2016. **The most recent imports are led by Refined Petroleum which represent 11.3% of the total imports of Maldives.**<sup>2</sup> Firewood and petroleum are the only commercial fuels, and firewood and liquefied petroleum gas are used for cooking in households. **As such the Maldives is extremely vulnerable to oil price variations in Asia and the Pacific.**

*STELCO, the State Electricity Company and Fenaka, a utility company to provide electricity, water, and sewerage services on the outer islands, together consumed nearly 120 million litres of diesel to produce electricity in the same year.*

The high dependence on diesel generators for electricity production has contributed to driving the retail tariffs of electricity extremely high in the country at about \$0.40 per kilowatt-hour<sup>3</sup>, several times more than other countries in the region. As a result, until 2016, the government granted subsidies for fuel surcharge and usage cover a portion of the cost of electricity for certain consumer categories, such as domestic consumers on the outer islands. However, these subsidies were subsequently withdrawn<sup>4</sup> to a certain degree.

## 1.2. Need for standards & labelling programme

Given that **electricity demand is expected to double by 2020 compared to the 2012** on the backdrop of an increase in usage by tourism sector, the government of Maldives is considering promoting alternative energy sources as a diversification strategy and to **support energy efficiency initiatives.**

**Consequently, the key features of the government's national energy policy include providing all citizens with access to affordable and reliable electricity services, increasing energy security, promoting energy efficiency and conservation, and moving toward the target of renewable energy based electricity supply.**

While the dispersed population in the outer islands invariably increases the costs of providing electrical services, and economies of scale are insufficient, the utilities will need to address the high variability in fuel conversion efficiency and distribution loss levels among the outer islands through investments in newer and more efficient mini-grids and control systems.

In the demand side, an energy efficiency standards & labelling program for electrical appliances is a key policy option in the government's arsenal to promote purchase and use of efficient appliances. In fact, a government

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<sup>1</sup> Source: <https://atlas.media.mit.edu/en/profile/country/mdv/>, retrieved on 13 February 2018

<sup>2</sup> Source: <https://atlas.media.mit.edu/en/profile/country/mdv/>, retrieved on 13 February 2018

<sup>3</sup> Source: ADB – Maldives' Energy Sector Assessment, retrieved on 13 February 2018

<sup>4</sup> Source: <http://maldivesindependent.com/politics/maldives-cuts-electricity-subsidies-121777>, retrieved on 14 February 2018



taskforce, the LCEI PMU, identified significant potential for supply- and demand-side energy efficiency through measures such as development of equipment codes and standards, measures for public buildings, and generator upgrades.

### ***1.3. Challenges in implementation of S&L program***

Some of the key challenges that exists towards implementation of the labelling programme for the appliances in Maldives based on the experience of project team are summarized below (these challenges will be further evaluated during the course of project):

- Lack of sufficient information on the best practices that are being followed internationally under the gambit of energy efficiency especially in appliance sector which is a key input for developing the labelling programme in Maldives as most of the local consumption is through import from other countries.
- Alignment/harmonization of global S&L programmes with respect to technical details of appliances will be a challenge
- For taking forward EE labelling programme, it is pertinent to reach out to consumers and understand the factors influencing their choice of selecting products. Keeping in view the diverse nature of local market needs, the energy efficiency legislation sets the mechanism to map these factors. Thus the labelling programme regulation should provide institutional and delivery mechanism for energy efficiency measures in Maldives and the much-needed coordination between the various entities. The proposed regulations needs to be revised to cover these aspects.
- Non-availability of testing standards and procedures for establishing energy performance for appliances.
- Country needs a thoroughly developed framework for monitoring and verification of policy measures especially for the labelling programme so that integrity is ensured.
- Absence of ESCO project (s) business models, market transformation strategies for uptake of energy efficient appliances, retrofit programme methodology etc.

### ***1.4. Scope of work***

In view of the above challenges, the present assignment intends to address the issues by providing support to MEE, MEA and key stakeholders through policy analysis, capacity building and implementation support for energy efficiency labelling programme. The assignment also **intends to support the government's initiative on** development of an implementation plan to fast-track the implementation of appliance labelling measures and create a sustainable pool of human resources in the country. The scope of work for the assignment is described below:

- Inception meeting with stakeholders and finalizing the detailed methodology and work plan
- Develop recommendation for an EE labelling programme
- Recommend EE labelling program implementation procedure
- Framework to monitor implementation of the EE labelling programme
- Impact assessment of enforcement of EE labelling programme
- Implementation plan for rolling out EE labelling programme
- Stakeholder sessions during development of EE labelling programme & dissemination workshop

## 2. Proposed approach

In light of our experience in development of S&L programs and understanding of the scope of work, we have proposed the following approach for the project.

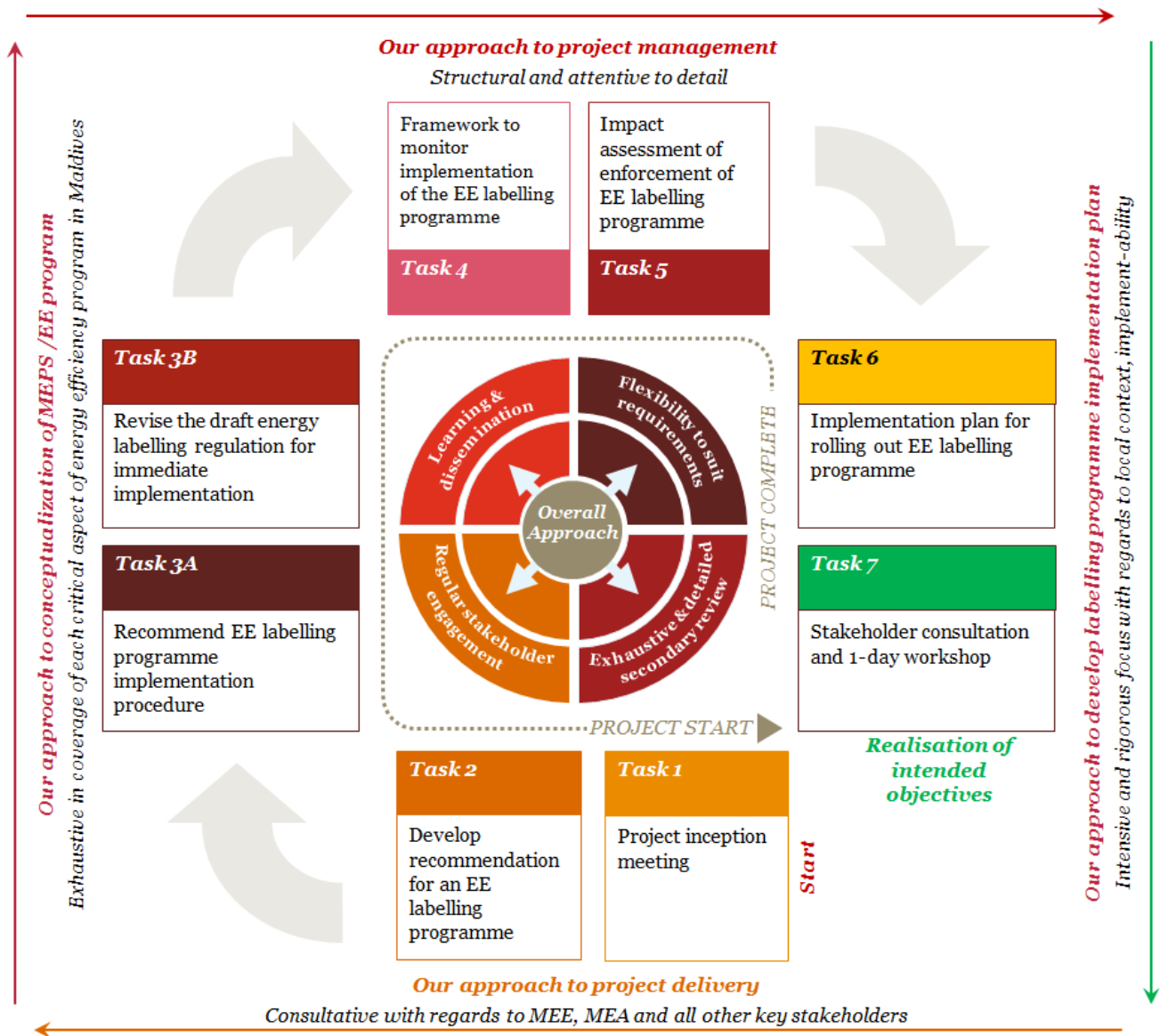


Figure 1: List of tasks and brief approach for the project

### 2.1. Task 1: Project inception meeting

The inception meeting is essential to ensure an effective start of the project; fine-tune mutual understanding of objectives, results and deliverables; gather existing information from stakeholders in Maldives to better address the expectations of the stakeholders; and actively initiate the relationships and alliances upon which the project will be implemented.

The project team shall work with officials from MEA to conduct a half-day inception workshop with major stakeholders on 7<sup>th</sup> February 2018. The proposed agenda for the workshop is attached in subsequent chapters of this report.

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## **2.2. Task 2: Development recommendation for an EE labelling programme**

*The task includes following sub-tasks:*

- a) Review and compare labelling scheme of countries from which selected appliances are imported into Maldives*
- b) Recommend energy efficiency levels for labelling scheme to categorize the selected appliances available in Maldives market, and its equivalence for labels issued by exporting countries*
- c) Recommend label format and information for labelling scheme in the Maldives*

**Imports make up a considerable portion of the Maldives' appliance market** - appliances of different brands and makes are available in the market. Naturally, the performance and energy efficiencies of each model of an **appliance depends on the source countries' norms and regulations. Therefore, it becomes important to assess the** existing efficiency levels of appliances sold in the market, and the various regulations followed.

This exercise supports alignment and harmonization of test procedures and standards in Maldives with those of importing countries. Harmonization allows countries, companies, and consumers to avoid the costs of duplicative testing and non-comparable performance information, thus benefiting from a reduction in these non-tariff trade barriers and from access to a widened market of goods.

Under this task, the team will study applicability of international EE labelling policies for the different shortlisted appliances. The team will conduct a detailed analysis of respective program in selected countries to understand the following aspects:

- Test standards followed
- Minimum requirements for parameters, Labelling criteria, any applicable MEPS etc.
- Implementation procedure, stakeholders involved,
- Label design, information displayed and other aspects
- Monitoring and enforcement procedure

**This information will be collected by reviewing each country's labelling legislations, websites, implementation procedures, guidelines & SOPs etc.** Based on the review of international programs and in consultation with MEA and LCEI project officials the team will identify the approaches for adopting international practices in the Maldives.

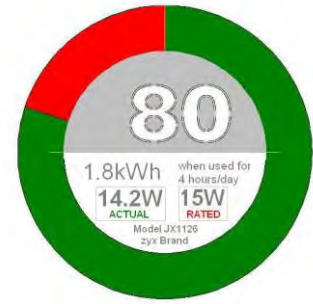
Deciding on the energy efficiency levels and complete labelling framework is a highly consultative process. The process requires deliberation between the key stakeholders on the practicality of efficiency levels with respect to that region as well as commitment towards the energy & economic situation in the country. The team will lead this discussion between key stakeholders and will then arrive at recommendations based on most acceptable efficiency level.

The next key sub-step is to recommend label format and information for labelling scheme in the Maldives. The label should cover aspects of energy efficiency, Ozone Depletion Potential (ODP) and low Global Warming Potential (GWP)

An effort to harmonize all information on energy labels among several countries could reduce the impact of the label in each country because the optimal design elements of an effective label may be different in different

cultures; symbols or graphic elements that work in one country may not necessarily transfer to another. Therefore, an energy efficiency label specific to the population in Maldives needs to be derived, taking into consideration local consumer preferences, importance for energy efficiency, harmonization with other EE schemes etc.

The MEE has already has a proposed design in the draft labelling regulation. The toroidal form of the label designates the energy rating, green segment indicating the grading achieved by a particular product and the red segment indicating the room for improvement. The digit on the middle illustrates it numerically. It is important to assess whether the label design & format is acceptable. The team will consultative discussions with local stakeholders to understand their inputs.



### ***2.3. Task 3A: Recommend EE labelling programme implementation procedure***

*The task includes following sub-tasks:*

- a. Recommend a process of implementing Maldives EE Labelling Programme, based on certification issued for labelling and documentations used for certification in exporting country.*
- b. Recommend process and approaches for establishing collaborative arrangements with labelling authorities of key exporting countries for verification of submissions to Maldives EE Labelling programme*
- c. Recommend process and procedures for importing the products into the country and process for Customs officials to approve the imports*
- d. Recommend process to confirm general quality of appliances to be labelled to ensure counterfeits cannot be imported into the country*

The task focuses on how the potential labelling program in Maldives will be implemented. Developing an implementation process is one of the prerequisites for smooth and successful execution of the labelling programme.

There are several options available for implementing the S&L program in Maldives. They include: 1) Affixing the label once appliances are imported. However, this creates an additional work step for retailers and this might be inefficient. The other option is having the label affixed in source countries, i.e. before import. This seems to be more efficient. Each of the options needs to be studied in detail to arrive most appropriate option of Maldivian context.

The following aspects need to be considered for developing an effective implementation process – 1) the existing procedure adopted for importing appliances into the Maldives, including stuff that manufacturers need to submit to Customs, and 2) possible submission requirements so that the label affixed can be verified for authenticity.

Once the roles and procedure for imports are clear, we need to dive deeper into the procedure for grant of label. Since models are neither designed nor manufactured indigenously, data and test reports generated from foreign labs must be utilized for grant of permission for fixing label. One probable mechanism is that importers submit test reports and other specification data for each model imported to MEA, and MEA can grant an authorization certificate for use of label. For any appliance affixed with a label to pass through customs, the certificate can be made mandatory. To design the implementation process, we will perform the following steps:

- Study the regulatory structure in the Maldives – especially the powers conferred to MEA regarding energy standards & labelling, and customs regarding imports

- Develop a draft implementation plan based on the roles and responsibilities of MEA, Customs and other stakeholders, and discuss with stakeholders.
- Finalize implementation plan after gaining inputs from stakeholders, and establish milestones for implementation in Maldives.

As the proposed labelling programme considers alignment with programs of importing countries, and the tentative implementation structure foresees importers submitting data corresponding to the labelling program in other countries, it becomes imperative for MEA to establish collaborative arrangements with labelling authorities of key exporting countries for verification of submissions.

However, models designed specifically for sale in Maldives, and therefore not registered elsewhere can pose an issue with implementation. To circumvent this issue, a provision could be introduced which makes it mandatory for products to receive an EE label from source country to be eligible for the EE label in Maldives. However, the practicality of such a solution needs to be assessed with appropriate data, which will be requested from importers during the course of the assignment.

The recommendations for importing the products in the country so that quality of products as well as its compliance with proposed EE labelling can be ensured are the most important requirement for a successful implementation.

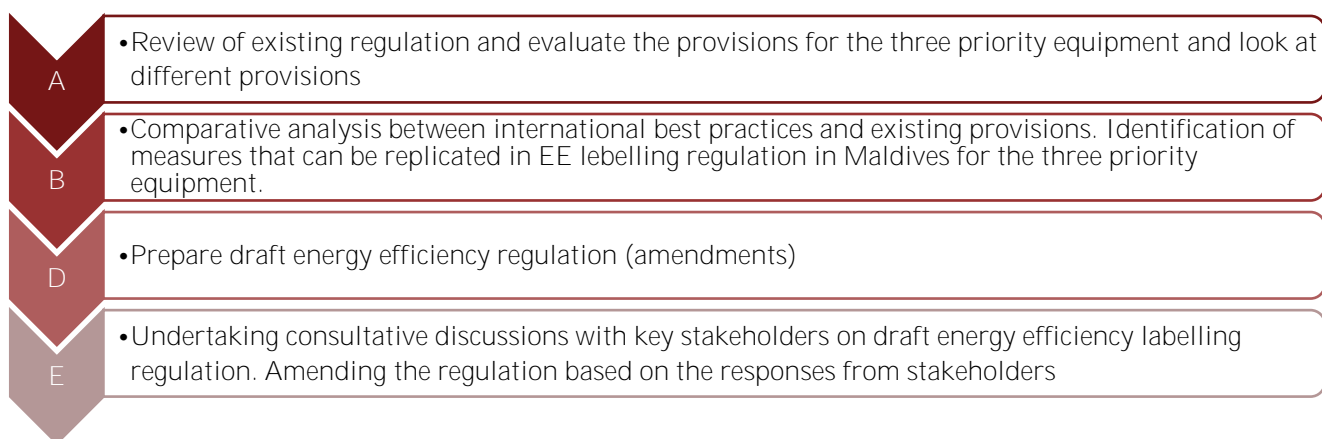
In order to incorporate energy efficiency standards in import and sales regulations the team will follow an extensive consultative approach to develop a draft process.

## ***2.4. Task 3B: Revise the draft energy labelling regulation to cater for the implementation of the Maldives EE labelling programme***

Once the implementation procedure is finalized and the process of ensuring monitoring of products during import is established, the team will prepare a final SOP for the EE Labelling program in Maldives. The team will also propose amendments to the regulation to facilitate MEE in implementing the labelling program in Maldives.

The national energy efficiency labelling regulation is an important tool to improve energy efficiency in the country. The regulation set requirements and provisions for trade, product qualification, scope, etc. that will govern the market dynamics. The regulations vary quite a bit between countries in several respects including the extent of its coverage, the specific requirements, means of attaining compliance and the enforcement system etc. In order to develop and implement energy efficiency standards and labelling regulation in Maldives the team will follow an extensive consultative approach.

Our **step by step approach** for this activity is shared below.



## 2.5. Task 4: Framework to monitor implementation of the EE labelling programme

The task includes following sub-tasks:

- a. Recommend process and procedures for market surveillance to ensure effective implementation of the EE Labelling Programme
- b. Review the existing roles & responsibilities of Government entities on market surveillance and recommend necessary amendments to include the roles and responsibilities for Market Surveillance
- c. Demonstration of market surveillance process and procedure to the relevant government entities
- d. Identify necessary regulatory changes to impose penalties, and recommend types & magnitude of penalties for non-compliance with requirements of the EE Labelling programme

In the context of the proposed S&L policies in Maldives, it is **necessary to define framework for market surveillance**. This would eventually **facilitate international cooperation and technology transfer and also build confidence within the local consumers**. Market surveillance is an internationally recognized protocol for assessing the product compliance.

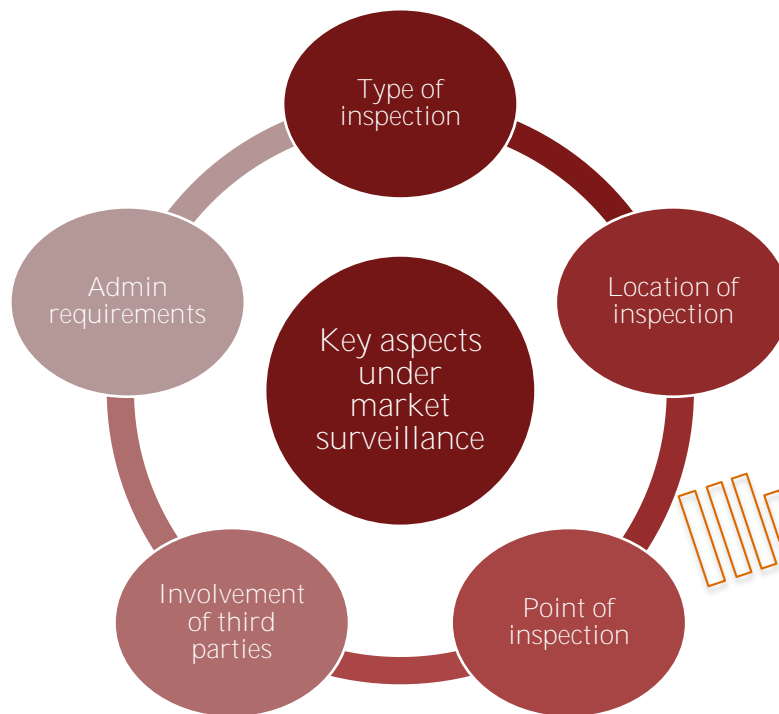
Surveillance is necessary to ensure authenticity of the program, and to maintain consumer confidence on the label. Several tiers of surveillance activities exist, all of which support the successful implementation of the programme:

- Surveillance during import to ensure that all appliances are affixed with labels, and those labels are as authorized by MEE
- Random market inspections and verification testing of samples to ensure that documents and test reports submitted by imports are not forged/fraudulent

Essentially, conducting monitoring through market surveillance would ensure that:

- All appliances covered under EE labelling regulation for the S&L programme are affixed with an energy label.
- Labels specify all required details as per respective regulation and particulars displayed on the label are correct.
- The label is displayed in the proper manner as defined. This includes size, shape, colour, place of display etc.
- Models for which directions have been issued by the MEA for their withdrawal from the market on account of failure / non-compliance have been withdrawn, etc.
- Enforcement actions could be taken if non-compliance occurs.

*There are several important factors MEA need to take into consideration while drafting the market surveillance plan. Some of which are described in the following figure.*



An illustrative information on each of key aspects mentioned above is shared below:

**Types of inspections:** In general, there are can be two types of inspections based on scope—**targeted inspection and general inspection.**

- **Targeted inspections** are conducted to verify the compliance of a particular model or a particular manufacturer with the provisions of the S&L programme. These are conducted for specific reasons such as verifying non-compliance of a particular model, non-availability at direction of MEA, etc.
- **General inspections** are not tied to one type of product or model. They consist of general surveillance activities in the marketplace or warehouses.



**Location of market surveillance:** Location of inspection refers to the type of location where the inspection is being conducted— smaller towns, distant islands, cities. The chances of non-compliance are higher in distant islands and smaller towns as compared to major cities because of the difference in consumer awareness towards the S&L programme and energy efficiency in general. Therefore, the location of inspection is an important factor.

**Point of inspection under market surveillance:** The point of inspection refers to that point in the supply chain where the inspection is being conducted. The points could be custom clearance, retail stores, distribution centres etc.

**Involvement of third parties for market surveillance:** Involvement of third parties in the inspection process is an important factor from an administrative, authenticity and practical point of view.

The project team will facilitate MEA and LCEI-PMU in establishing a framework for market surveillance in Maldives. The team will provide support for the points mentioned above as well as for preparation of an exhaustive plan for market surveillance in Maldives. A demonstration activity would be conducted for local stakeholders and consumer to explain inspection plan.

## **2.6. Task 5: Impact assessment of enforcement of EE Labelling programme**

The task includes following sub-tasks:

- a) *Develop a monitoring framework, including indicators for assessing impacts of EE Labelling programme, data requirements, process and procedures for data collection, to assess the energy savings and GHG impacts of implementation*
- b) *Identification of relevant stakeholders collaboration for harmonization of data*
- c) *Carbon dioxide reduction impact for next ten years*
- d) *Provide estimates of the potential energy and energy cost saving, along with other social economic impacts, with introduction of EE Labelling programme in the Maldives*
- e) *Recommend the feasibility of restricting import of selected appliances below a minimum standard/minimum efficient level.*

Developing the programme monitoring protocol is the most vital and crucial component of the exercise. It is important for the team to thoroughly examine the programme components and develop a protocol, which will have high credibility and acceptability. In this section, we have briefly structured the steps that we will undertake to develop a thorough, scalable monitoring protocol as per the scope of the programme. Broad steps are shared below:

*Examine Theory of Change and lay the key drivers of programme i.e. inputs, activities, outputs, and outcomes*

*Examine Logical Framework and capture the goal, objectives, outcomes, outputs, and inputs of the program. Also assess the targets and milestones required to be achieved across the different timelines*

*Undertake thorough review of programmatic and donor objectives, past work done*

*Develop a draft M&E framework and discuss with MEA and LCEI-PMU and key national stakeholders*

*Finalize the protocol, collect requisite data /information and evaluate the results*

The steps given will be undertaken in close consultation with MEA and LCEI-PMU.



Based on the protocol and analysis of energy savings and GHG reduction discussed above, the team will evaluate the projected achievement from the project for a period of next ten years. The methodology for mapping the project impact during frequent intervals such as Year-on-Year / Mid-term and End Term will be formulated in consultation with MEA. Other than the estimated savings, the methodology will also cover the socio-economic achievement from the implementation of EE labelling programme in Maldives.

## **2.7. Task 6: Implementation plan for rolling out EE Labelling programme**

*The task includes following sub-tasks:*

- a) Assess capacities in implementing the different elements of EE Labelling programme*
- b) Identify cost of implementing EE Labelling programme and options for recovering the costs*
- c) Develop an implementation plan*

Developing implementation plan for mandatory S&L programme and launch methodology

Once the energy standards are set and monitoring protocol is marked, the policy makers shall proceed for launching the S&L programme. The introduction of the labelling programme for the shortlisted appliances shall be accompanied by an outreach campaign to provide information to the consumers about the labelling programme and the benefits of this programme to the individual consumer, society and private sector. The market dynamics of the appliances shall be tracked with a view to assess the penetration of the labelled products in the market. Once the programme gains maturity, the introduction of stringent standards and further expansion can be planned.

The project team along with key implementing partners and stakeholders shall evaluate the need for steps to be taken for implementation of labelling. An outreach plan shall be developed to spread awareness at large scale. The team will support the MEA and LCEI-PMU with a few ideas for market transformation approaches.

A detailed implementation plan would be developed. The implementation plan will broadly covers seven major steps as shared below:

1. Designing of communication campaign & outreach plan
2. Launch of S&L programme
3. Establishing protocols for conduct of Monitoring & Verification (M&V)
4. Establishing provision for enforcement
5. Training & capacity building of stakeholders
6. Cost involved for implementing the programme and methodology for recovery of cost

The implementation plan will be developed in discussion with MEA and LCEI-PMU. The sub-activities within these steps and respective output will be tabulated in the plan and will be linked with timeline of completion. The implementation plan will be developed in the form of a Gantt chart so that real time monitoring could be done.

**An illustrative example for recovery of cost could be ‘labelling fees’ or ‘product application fee’ etc. This is being practices at India wherein the implementing ‘Bureau of Energy Efficiency’ has formulated a fee for registration of product under labelling scheme called as application fee. Also, there is a labelling fee respectively for each appliance covered under the S&L programme. The labelling fee is an amount associated with production /sales of labelled appliances in the country. For example, if 5 MVR is a labelling fee for air conditioner and 100 nos. of labelled air conditioners are sold in Maldives during a year. Then the total labelling fee to be paid to the**

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implementing body will be 500 MVR. This is generally paid by the producer of product / who is affixing the respective label on the appliance.

The cost examples discussed above as well as internationally practiced strategies will be studied in more detail with respect to the local context in Maldives to arrive at a most acceptable implementation strategy.

## ***2.8. Task 7: Conduct stakeholder consultation sessions during the development of the EE Labelling programme and a dissemination workshop to present the EE labelling scheme to stakeholders***

The project team will remain bound and will provide complete support to MEA, LCEI-PMU in all stakeholder consultation sessions. The key activities of the project team in the meetings will be (and not limited to):

- Supporting in formulating the stakeholder committee and collating information on contact details of members
- Discussion with MEE, MEA, LCEI-PMU, on activities to be discussed in larger stakeholder group
- Defining the agenda for the meetings
- Supporting in inviting the members for meeting
- Prepare the presentation to be discussed in the meeting
- Support in discussions during the meeting

A dissemination workshop will be conducted. The workshop is a means of inviting national & international experts to understand findings of the study. The workshop would give chance to all stakeholders to understand key sensitivities, role of different stakeholders and future requirements towards uptake of energy efficient equipment.

## 3. Project initiation – contract signing ceremony

### 3.1. Award of contract and signing ceremony



*Figure 2: Contract signing ceremony held on 09 January 2018*

A ceremony for signing the contract for “development of energy efficiency labelling programme in Maldives” was held on 09 January 2018 in the Auditorium, Ministry of Environment and Energy, Maldives. The project team from PwC India undertook their first mission to Maldives for the ceremony and initiating the project activities.

Honourable Thoriq Ibrahim, Minister of Environment and Energy signed the contract on behalf of the Ministry and Mr. Amit Kumar, Partner, signed the contract on behalf of PricewaterhouseCoopers Private Limited. Honourable Abdullahi Majeed, Minister of State, MEE and Mr. Rajeev Ralhan, Director, PwC, witnessed and also signed the contract on behalf of their respective organizations.

Honourable Minister conveyed the importance of this project from the viewpoint of energy efficiency. He shared that the government is focussing on initiatives and practices to address climate change issues and will initiate policy measures to facilitate implementation of such practices. It was shared that the objective of the assignment is to initiate the implementation of an energy efficiency labelling (EE Labelling) programme for selected



appliances in the Maldives. Under the consultancy, PricewaterhouseCoopers will develop detailed methodology to issue energy efficiency labels for selected appliances along with necessary forms, documentation, and to develop monitoring methodology for the Labelling programme.

Mr. Amit Kumar conveyed his gratitude to the Ministry for organising the ceremony. He welcomed all stakeholders present during the ceremony and shared that this is an important assignment for Maldives as the development of standards and labelling programme under this project will not only facilitate uptake of energy efficient appliances in the Maldives but will also facilitate the country in meeting climate change goals. He shared a few insights from his experience highlighting the successful implementation of S&L programmes in various countries globally. He also shared his experience of working with MEE in past for one of the projects related with clean energy and highlighted that the team will once again closely work with local authorities for development of S&L programme in a manner in which the programme gets push from the market on its own.

The signing ceremony ended with a vote of thanks to the dignitaries and was followed by tea and snacks.

### ***3.2. Introductory discussions***

Post signing ceremony the team from PwC conducted a few rounds of discussions with officials of LCEI project and MEA over the next two days. The progress that have been made so far in Maldives through studies conducted in past was discussed. Also, the overall approach for undertaking specific tasks under the project was presented in brief to understand the expectations of MEA.

Key members present in the discussions are:

- Mr. Mohamed Inaz, LCEI Project Manager, MEE
- Ms. Fathimath Raufa Moosa, LCEI Project M&E Officer, MEE
- Mr. Muawiyath Shareef, Director – Technical Regulations, MEA
- Mr. Akram Waheed, Engineer – Technical Inspections, MEA
- Ms. Shara Mauroof Ahmed, S&L Officer, MEA
- Mr. Rajeev Ralhan, Director, PwC
- Mr. Mohit Verma, Manager, PwC

Following is the brief summary of key discussions:

**Highlights on the work done so far:** To begin with the project manager from LCEI project, Mr. Inaz shared some key insights on the work done in past for preparation of S&L program. He briefly shared the outcomes of studies such as:

- Development of manual for official recommended electric appliances approval procedure by JICA in 2010
- Development of consultation paper and draft energy labelling regulation by Mercados in 2012
- Research on Consumer Behaviour and Preferences Regarding Energy Efficiency in Households by Riyan Pvt. Ltd. in 2017, under the aegis of the LCEI project
- Technical Analysis of Market to Develop Energy Efficiency Labels in Maldives in 2017, under the aegis of the LCEI project

Mr. Inaz and colleagues shared that the report from JICA is useful to understand the thought process behind the labelling programme and although the findings of the report would need to be reassessed based on the current

market dynamics of appliances and international best practices for energy efficiency labelling programme. It was shared that the market analysis and consumer research done in recent past will be very useful for the intended outcomes under the proposed study. He also shared that the information covered under the market analysis report is authentic as it has been obtained from customs. The team from PwC enquired about the technical details of the appliances for which market analysis was done. Mr. Inaz shared that though their partners tried to obtain the technical details of **appliances but that information wasn't available with customs and the information from importers was very limited.**

The team from PwC thanked Mr. Inaz and his colleagues for taking them through on the work done in past. Mr. Rajeev requested the copy of reports and documents for a detailed review so that the team can take cues from the earlier studies. Mr. Inaz accepted and shared the copies with the team for reference.

**Discussion with MEA:** The team from PwC requested a brief discussion with MEA officials to understand their existing setup and planning for implementation of standards and labelling programme. The officials from MEA shared that they have recently recruited one resource in the capacity of S&L officer. The officer will closely work with LCEI **project personnel and PwC's project team for development of S&L programme in the Maldives.** The project team requested the details from MEA such as: legal mandate for development of energy standards and labelling scheme; legal provision of taking actions against non-compliance of standards; institutional capacity as on date for the implementation of labelling programme; their expectation from the project, etc. The officials from MEA informed that they will share the details of legal mandate with project team. It was shared that MEA is working on introduction of a new electricity act to regulate the aspects under energy supply and installation and in some section there will be convergence with the requirements under energy efficiency labelling programme. It was shared that as of now mechanism or rule for penalising the defaulters of regulations /standards made by MEA is not available however with the revisions in electricity act such requirements can be addressed. Regarding the institutional capacity, it was shared **that MEA's existing team structure is lean and they** will be expanding their existing structure in near future with the development of S&L programme. The MEA officials requested the project team to share a roadmap of activities that are important from the viewpoint of implementation of S&L programme. The project team thanked the members of MEA for joining the discussions.

**Discussion towards conducting inception workshop:** There was a brief discussion on the schedule for project inception meeting cum workshop wherein a few stakeholders could also attend and facilitate in data collection. It was jointly discussed and proposed that the half-day workshop should be conducted either on 6<sup>th</sup> or 7<sup>th</sup> of February 2018. The local stakeholders who will attend the workshop was also decided. The details are mentioned in the workshop agenda attached in subsequent chapters of this report.

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## ***4. Market analysis & selection of countries for assessment of international S&L programs***

Market analysis is one of the most important steps in development of a standards and labelling programme. Typically, a market analysis includes, information about appliances prevalent in an economy; classification of appliances; key brands and types available; annual consumption of appliances in the economy; key technical specifications of the appliances; present efficiency levels, availability of standard as well as efficient models, local manufacturing, import share, and projected market growth etc. This entire information not only facilitates in **capturing the real picture of country's market for a respective appliance but also facilitates in design & development energy standards and labelling scheme**. The results of the market analysis often provide a starting point for completing the other crucial steps in development of a labelling program.

One the key initial steps for the market analysis is to assess the share /capacity of local manufacturing with that of import of appliances. The economies where the appliances under the consideration of energy efficiency schemes are locally manufactured in significant numbers, the governments usually attempts to create standards which are focused on efficient technologies as well as provides opportunities to local manufacturers to make gradual advancements in the overall value chain of products. On the other hand, for import driven economies the focus is usually on introduction of measures through which efficient technologies could be promoted and import of inferior products could be avoided. The collection of market data in both cases is very important for the design of standards and labelling programme. However, the data collection methodology slightly differs in both cases.

In the case of the Maldives, as the market is entirely import-driven, the local manufacturing and/or assembly of appliances is negligible. Therefore, import data is a good estimate of the local market in the country. The data for appliances which are imported in the country could be obtained from customs and local importers.

Incidentally, the Ministry of Environment and Energy (MEE) initiated a study in September 2016 titled **“Technical Analysis of Market to Develop Energy Efficiency Labels and Standards Programme in the Maldives”** in order to assess and support government decision making on the most suitable energy efficiency labels and standards for the Maldives.

The study sheds light on the monetary value of each appliance type, the quantity of appliances imported, key importers, brands sold, countries of manufacture, countries of shipping origin, annual energy consumption, and forecasted trends for each appliance. A total of eight appliances, including air conditioners, refrigerators, and washing machines, are covered in the study.

The final draft of the report was shared with PwC by LCEI team, **and the study's findings** are very significant for the market assessment exercise. The synopsis of our findings relevant to this task are shown below.

### ***4.1. Review of market analysis study***

The study conducted an analysis of data gathered for the electrical appliance market in the Maldives. The overall purpose of the market analysis conducted is to support MEE & the government in decision making on the most suitable energy efficiency labels and standards for the Maldives. The report aims to enable meaningful comparisons among appliance types at a macro-level, which are helpful and necessary to policymakers in the further development of energy labelling and energy efficiency standards in the Maldives.

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The appliances analysed under the market analysis work includes:

- Air conditioners,
- Refrigerators and freezers,
- Washing machines,
- Televisions,
- Lights,
- Electric ovens,
- Electric water heaters,
- Water pumps, and
- Electric fans.

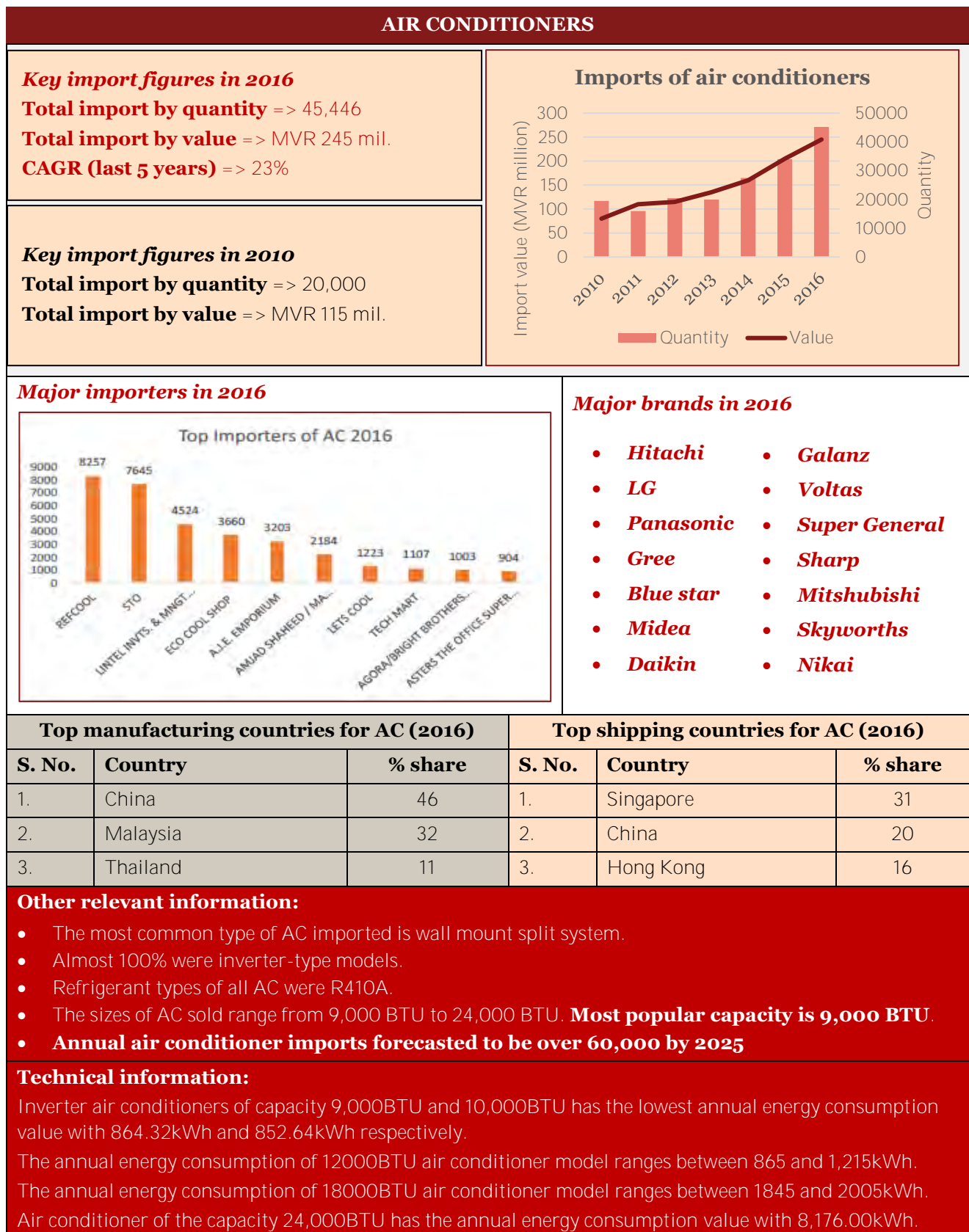
The following aspects for each appliance mentioned above has been studied in the Maldivian context:

- Quantity imported
- Key importers
- Brands sold
- Countries of manufacture, and countries of shipping origin
- Growth forecasts

The findings from market analysis reports have been studied in detail for three appliances that have been shortlisted for S&L programme i.e. Air conditioners, Refrigerators, and Washing machines. A summary of the most relevant information for these three appliances as per the details presented in the market analysis report are shown next.

### 4.1.1. Summary of market information for air conditioners

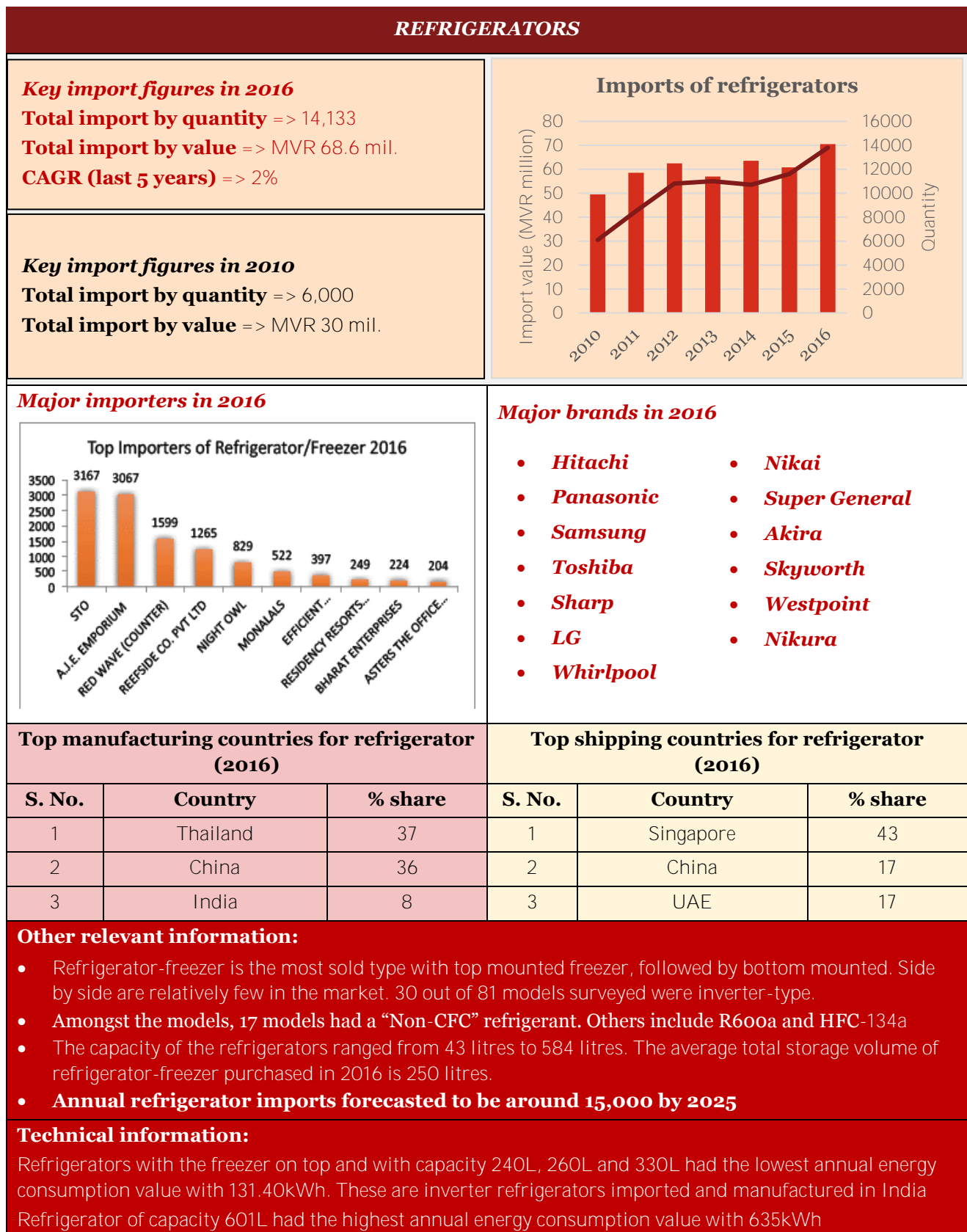
Table below provides summary of market size, trend, key importers, major brands and few technical details for air conditioners in the Maldives.





## 4.1.2. Summary of market information for refrigerators

Table below provides summary of market size, trend, key importers, major brands and few technical details for refrigerators in the Maldives.



### 4.1.3. Summary of market information for washing machines

Table below provides summary of market size, trend, key importers, major brands and few technical details for washing machines in the Maldives.

<b>WASHING MACHINES</b>					
<p><b>Key import figures in 2016</b>  <b>Total import by quantity =&gt; 15,168</b>  <b>Total import by value =&gt; MVR 35.5 mil.</b>  <b>CAGR (last 5 years) =&gt; almost zero</b></p>			<p style="text-align: center;"><b>Imports of washing machines</b></p>		
<p><b>Key import figures in 2010</b>  <b>Total import by quantity =&gt; 10,000</b>  <b>Total import by value =&gt; MVR 10 mil.</b></p>					
<p><b>Major importers in 2016</b></p>			<p><b>Major brands in 2016</b></p> <ul style="list-style-type: none"> <li>• <b>Panasonic</b></li> <li>• <b>Super general</b></li> <li>• <b>Toshiba</b></li> <li>• <b>LG</b></li> <li>• <b>Geepas</b></li> <li>• <b>Nikai</b></li> <li>• <b>Samsung</b></li> <li>• <b>Sharp</b></li> <li>• <b>Lanza</b></li> <li>• <b>Singsung</b></li> <li>• <b>Hitachi</b></li> <li>• <b>Whirlpool</b></li> <li>• <b>Beko</b></li> </ul>		
<p style="text-align: center;"><b>Top manufacturing countries for washing machines (2016)</b></p>			<p style="text-align: center;"><b>Top shipping countries for washing machines (2016)</b></p>		
<b>S. No.</b>	<b>Country</b>	<b>% share</b>	<b>S. No.</b>	<b>Country</b>	<b>% share</b>
1	China	58	1	China	44
2	Thailand	17	2	Singapore	22
3	India	8	3	UAE	19
<p><b>Other relevant information:</b></p> <ul style="list-style-type: none"> <li>• Top loaders are dominant in the market.</li> <li>• Most products are in the range of 5kg to 14kg capacity.</li> <li>• Washing machine imports forecasted to be around 25,000 by 2025.</li> <li>• <b>Nearly all households contain at least one washing machine that is operating a minimum of once a week</b></li> </ul>					
<p><b>Technical information:</b></p> <p>Average energy consumption for washing machines is 160kWh/year  an inverter front load auto washing machine had the least annual energy consumption with 122kWh (7 kg, A+++ EU label)</p>					

A non-inverter auto top load washing machine had the highest annual energy consumption with 184.32kWh (10 kg, 5 star Thailand label)

#### 4.1.4. Key findings and approach for collection of remaining data

The market analysis report shared by MEA has extremely relevant information regarding the import numbers, forecasts, source countries, brands sold, and major importers in the Maldives market. However, the development of a labelling program will require some more details on aspects such as type-wise segregation, capacity-wise segregation etc. This information is extremely important because of the following reasons:

- Unless the information on type and capacity wise appliances is available the scope of programme will remain generic and will not be realistic,
- The comparison of local market with that of markets in other countries will not be feasible,
- The data will facilitate in assessing the technical parameters in a better manner, etc.

The information required is summarized below:

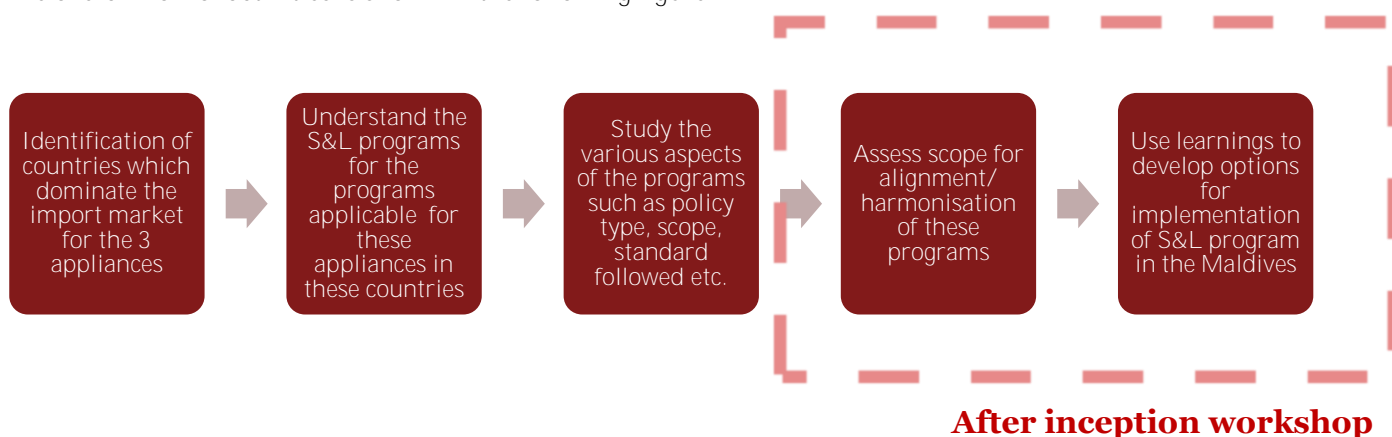
S. No.	Information required	Relevant stakeholders for the data	Proposed strategy for data collection
1.	Type-wise segregation for the appliances for example: market information about semi-automatic, fully-auto top loading and fully-auto front loading machines	<ul style="list-style-type: none"> <li>• Retailers/importers association in the Maldives</li> <li>• Customs</li> </ul>	Questionnaire based survey & in-person meetings with retailers /importers and Customs officials  The strategies and available option will be discussed with MEA and LCEI project officials
2.	Capacity-wise segregation for the appliances for example: market information for washing machine of different loading such as for 5 kg, 5.5 kg etc.	<ul style="list-style-type: none"> <li>• Retailers/importers association in the Maldives</li> <li>• Customs</li> </ul>	
3.	Segregation of import /sales of 3 appliances by efficiency grades. For example, what is the share of 5-star labelled appliances sold in Maldives?	<ul style="list-style-type: none"> <li>• Retailers/importers association in the Maldives</li> <li>• Customs</li> </ul>	
4.	Acceptability of efficient appliances by consumers	<ul style="list-style-type: none"> <li>• Retailers</li> <li>• Consumer behaviour study</li> </ul>	Conduct surveys and interviews with a few selected retailers and consumers Review of consumer behaviour study
5.	Technical data for the 3 appliances such as energy consumption details as per the relevant standard according to which the product has been certified, other performance related parameters	Exporters of the appliances and respective counter-parts	To be discussed during inception
6.	Details displayed on the various labels	Importers	To be discussed during inception

For point (1), (2) and (3) mentioned above, the draft questionnaires for respective appliances have been prepared and enclosed in **Annexure A**.

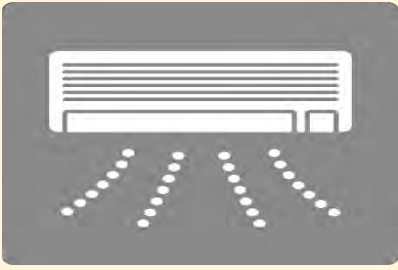
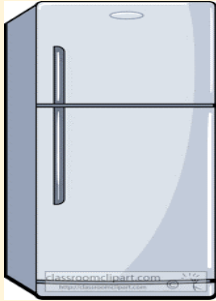

#### 4.1.5. Analysis of key countries from where the 3 appliances are imported

The majority of appliances sold in the Maldives' market are imported. Naturally, the performance and energy efficiencies of each model of an appliance depends on the source countries' norms and regulations. Therefore, it becomes important to assess the existing efficiency levels of appliances sold in the market, and the various regulations followed. This is accomplished through this exercise.

The overall flow of activities is shown in the following figure:



The major countries from which import of the 3 appliances take place are shown in the following table. *The results are based on the import statistics of 2016 as reported in the market assessment report.*

 Air-conditioners			 Refrigerators			 Washing machines		
Country	% by country of shipping	% by country of manufacture	Country	% by country of shipping	% by country of manufacture	Country	% by country of shipping	% by country of manufacture
China	20%	46%	China	17%	36%	China	44%	58%
Singapore	31%	-	Singapore	43%	7%	Singapore	22%	-
Hong Kong	16%	-	UAE	17%	-	UAE	19%	-
Malaysia	12%	32%	Thailand	10%	37%	Thailand	-	7%
India	11%	-	India	8%	8%			
Thailand	-	11%						

The countries from which most air-conditioners, refrigerators and washing machines are imported are shown in the table above.

The team identified the presence of energy efficiency programme for the respective appliances in these countries. The summary of programmes is shared below:

Air-conditioners			Refrigerators			Washing machines		
Country	Program type	Voluntary or mandatory	Country	Program type	Voluntary or mandatory	Country	Program type	Voluntary or mandatory
<b>China</b>	Comparative labelling MEPS Endorsement labelling	Mandatory	<b>China</b>	Comparative labelling MEPS Endorsement labelling	Mandatory	<b>China</b>	Comparative labelling MEPS Endorsement labelling	Mandatory
<b>Singapore</b>	Comparative labelling	Mandatory	<b>Singapore</b>	Comparative labelling	Mandatory	<b>Singapore</b>	Comparative labelling	Mandatory
<b>Hong Kong</b>	Comparative labelling	Mandatory	<b>UAE</b>	Comparative labelling	Mandatory	<b>UAE</b>	Comparative labelling	Mandatory
<b>Malaysia</b>	Comparative labelling	Mandatory	<b>Thailand</b>	Endorsement labelling	-	<b>Thailand</b>	Endorsement labelling	-
<b>India</b>	Comparative labelling	Mandatory	<b>India</b>	Comparative labelling	Mandatory			
<b>Thailand</b>	Endorsement labelling	-						

The project team has conducted an initial review of the existing programmes for each country as shown in the above table. The initial level findings from each country programme is covered in subsequent chapters of this report.

# 5. Analysis of global programs for air conditioners

A review of existing standards and labelling programmes have been carried out in order to understand the different provisions implemented in other parts of the world, and which of these provisions can be applied to the Maldivian context.

To this end, S&L programmes implemented across five countries are to be studied. These countries are selected on the basis of their shares in the air conditioner import market in the Maldives in 2016.

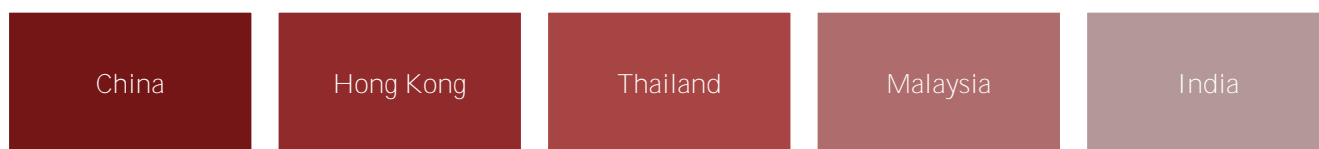


Figure 3: S&L programmes reviewed for air conditioner

The following aspects have been covered under the assessment so far:

- Type of programme
- Scope
- Implementing body
- Parameters covered
- Test standards prescribed
- Energy efficiency criteria

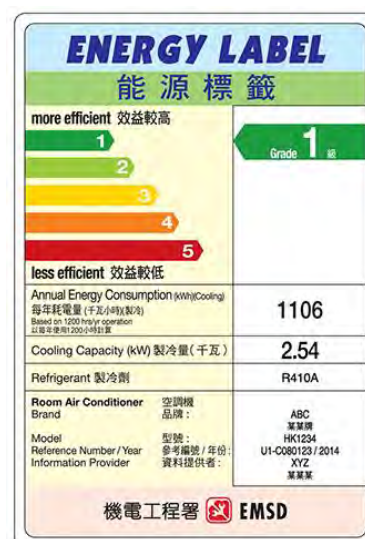
## 5.1. Programme in Hong Kong

The Government of Hong Kong, in 2008, introduced MEELS through the Energy Efficiency (Labelling of Products) Ordinance in order to generate public awareness and promote the use of energy efficient appliances. Under MEELS, it is mandatory to show an energy label for prescribed products for supply in Hong Kong. Under the ordinance, importers or manufacturers cannot supply a particular product unless it is a listed model with a reference number. The Director of Electrical and Mechanical Services (the Director) is the main authority concerned with MEELS.

Also, the labelling standards are regularly updated to keep up with advancement in technology and current status of market for energy efficiency in Hong Kong.

The MEELS program in Hong Kong applies to all room air conditioners, which include single package type and split type room air conditioners which use mains electricity as the primary power source, operate by using the vapour compression cycle, are non-ducted, are air-cooled, and **have a rated cooling capacity not exceeding 7.5 kilowatts**.

The Ordinance, prescribing the mandatory energy efficiency label, applies to both cooling only type and reverse cycle type air conditioners.



## Classification of room air conditioners

All room air conditioners regulated under the Ordinance are classified in the following manner:

Type	Function	Category	Description
Single package	Cooling only	Category 1	A single package type room air conditioner with cooling function only
	Reverse cycle	Category 2	A single package type room air conditioner with both cooling and heating functions
Split	Cooling only	Category 3	A split type room air conditioner with cooling function only
	Reverse cycle	Category 4	A split type room air conditioner with both cooling and heating functions

For all categories, room air conditioner is further classified into four types - fixed capacity type room air conditioner, two-stage capacity type room air conditioner, multi-stage capacity type room air conditioner, and variable capacity type.

### Parameters displayed

- Energy efficiency grade
- Annual energy consumption (kWh/year)
- Cooling capacity (kW)
- Refrigerant used
- Model number, brand details etc.

### Test standards followed

The program requires the following tests performed for each AC model:

- Cooling capacity tests in accordance with Annex A of ISO 5151.
- Maximum cooling performance test in accordance with the test methodology and performance requirements as specified in clause 5.2 of ISO 5151

### Determination of energy efficiency grading

The energy efficiency grade of the room air conditioner **is determined through the value of the AC's** Cooling Seasonal Performance Factor (CSPF). Grade 1 is provided for the best performance and Grade 5 for the worst.

Energy efficiency grade	Cooling Seasonal Performance Factor (CSPF)	
	Single Package	Split type
Grade 1	$3.00 \leq \text{CSPF}$	$4.50 \leq \text{CSPF}$
Grade 2	$2.80 \leq \text{CSPF} < 3.00$	$3.50 \leq \text{CSPF} < 4.50$
Grade 3	$2.60 \leq \text{CSPF} < 2.80$	$3.15 \leq \text{CSPF} < 3.50$
Grade 4	$2.40 \leq \text{CSPF} < 2.60$	$2.80 \leq \text{CSPF} < 3.15$
Grade 5	$\text{CSPF} < 2.40$	$\text{CSPF} < 2.80$

In order to obtain Grade 1 to 4, the room air conditioner concerned must also pass the maximum cooling performance test. Otherwise, the model will only be eligible for Grade 5.

## Calculation of Cooling Seasonal Performance Factor (CSPF)

The cooling seasonal performance factor (CSPF), FCSP, of the room air conditioner is calculated as follows:

$$F_{CSP} = \frac{L_{CST}}{C_{CSE}}$$

Where,  $L_{CST}$  is the cooling seasonal total load to be calculated in accordance with ISO 16358-1

$C_{CSE}$  is the cooling seasonal energy consumption to be calculated in accordance with ISO 16358-1

The defined cooling load and the outdoor temperature bin distribution is as shown below:

Defined cooling load		
Parameter	Load zero (o)	Load 100%
Cooling load (W)	0	$\phi_{ful}(t_{100})$
Outdoor Temperature (°C)	$t_o = 23^{\circ}\text{C}$	$t_{100} = 35^{\circ}\text{C}$
<p>where <math>\phi_{ful}(t_{100})</math> is the cooling capacity at <math>t_{100}</math> at full load operation condition  <math>t_{100}</math> is the outdoor temperature at 100 % load and <math>t_o</math> is the outdoor temperature at 0 % load.</p>		

Outdoor temperature bin distribution														
Bin no. <i>j</i>	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
Outdoor temperature (°C)	24	25	26	27	28	29	30	31	32	33	34	35	36	-
Bin hours (hour)	67	117	147	177	210	183	114	75	56	33	15	5	1	1200

## Monitoring and verification

The key aspects of MV&E practices in Hong Kong (considering refrigerator as a sample case) are shared below:

- The governing law is the Energy Efficiency (Labelling of Products) Ordinance that was passed in May 2008. The products that come under the purview of the ordinance are mentioned in its Annexures.
- The ordinance specifies that the Director of Electrical and Mechanical Services Department (the Director) is responsible for the enforcement of the scheme.
- The programme has a self-certification system wherein the manufacturers and importers are required to register all products covered by the programme before they can be sold. An application for registration and necessary documents must be submitted to the Director.
- The Director provides the authority to affix the label based on the information submitted by the applicants and conducts verification and enforcement checks post labelling. The Government of Hong Kong has published a Code of Conduct to guide stakeholders for discharging their duties.
- The Director is authorised to conduct compliance monitoring in order to verify the claims made by manufacturers and importers through verification testing. The samples of products are arranged from the market. The procedure is mentioned in the Code of Conduct.
- Where a product fails an initial screen test on a single sample, a further set of tests on multiple (usually three) samples is used to confirm the non-conformance of the model.



## Other requirements

Parameter	Requirement
The measured cooling capacity from full capacity test at standard cooling condition (T1 climate)	Minimum 95%
The measured power consumption from full capacity test at standard cooling condition (T1 climate)	Not greater than 110%
Cooling Seasonal Performance Factor	Minimum 90% of rated cooling seasonal performance factor
maximum cooling performance test	Must pass

In addition to the energy efficiency performance requirements, all room air conditioners shall comply with the Electrical Products (Safety) Regulation, Chapter 406G of the Laws of Hong Kong, and the safety standards specified under the Regulation, and all other legislations concerning the safety of the room air conditioners.

## 5.2. Programme in Thailand

The Green Labelling criteria applies to room air conditioner used with air-cooled condenser or evaporative condenser in order to decrease temperature and humidity only. However, the air conditioner must have a net total cooling capacity not exceeding 12,000 W operating on either single-phase or three-phase AC circuits of frequency 50 Hz.



### Test standards followed

Product shall be certified to Thai Industrial Standards for Room air conditioners: Energy efficiency, TIS 21343 and TIS 385 or Thai Industrial Standards for Air-cooled split type room air conditioners, TIS 1155.

Product shall be certified to Thai Industrial Standard or pass the product safety tests according to TIS 15294 or IEC 60335-2-405 or equivalent standard

### Other requirements

Sound pressure level of an air conditioner shall comply with the following requirements:

Type of air conditioner, Cooling Capacity	Sound pressure level (dB)	
	Indoors	Outdoors
Single pack	≤ 55	≤ 60
Split, ≤8 kW	≤ 50	≤ 57
Split, >8 kW to 12 kW	≤ 57	≤ 63

*A copy of sound pressure level test report using test method according to JIS C 9612 or equivalent standard must be submitted by the applicant.*

- Ozone depleting potential (ODP) of Refrigerant shall not exceed 0.5 and Global warming potential (GWP100a) shall not exceed 2500
- Product shall be designed to promote recycling, which by means of supplying recyclable plastic components at least 80% by weight of plastic components in product

- Energy efficiency of product shall comply with EGAT Label No.5. (Updated edition on application date for Green Label certification)
- Each plastic component of an air conditioner which weighs more than 25g shall contain heavy metals or their compounds and flame retardants, additional requirements are present in the document.

### 5.3. Programme in Malaysia

Malaysia is the second top manufacturer of ACs imported to the Maldives. **They have a star rated energy label, the number of stars determine the level of energy efficiency.** An appliance with a 5 star rating will be the most energy efficient.

For air conditioners, single split wall mounted air conditioner capacity up to 25,000 Btu/h are covered under the program scope.

#### Prescribed test standard

MS ISO 5151:2004

MS 2597:2014

#### MEPS level

**MEPS's value = 2 Star**

#### Energy Efficiency grading

The energy efficiency grade for an air conditioning appliance is determined by calculation of its Energy Efficiency Ratio (EER). The star rating is determined according to the following table



Star rating	Tested EER (Btu/h)/W	
	Cooling capacity < 4.5kW	4.5kW < cooling capacity < 7.1kW
5	≤11.94	≤10.71
4	11.16 - 11.93	9.83 - 10.70
3	10.37 - 11.15	8.94 - 9.82
2	9.56 - 10.36	8.03 - 8.93
1	9.00 - 9.55	7.50 - 8.02

The Energy Efficiency Ratio (EER) is the ratio of the total cooling capacity to the effective power input at any given set of rating conditions. The unit is (Btu/h)/W.

The cooling capacity value shall be determined in accordance with the MS ISO 5151 or identical under condition stated below:

- 100 % load cooling capacity test (inverter and non-inverter air conditioners)
- 50 % load cooling capacity test (inverter air conditioners only)

For inverter air conditioners, the weighted EER is calculated as:

$$\text{Weighted EER} = \left(0.4 \times \frac{100\% \text{ load cooling capacity}}{100\% \text{ load input power}}\right) + \left(0.6 \times \frac{50\% \text{ load cooling capacity}}{50\% \text{ load input power}}\right)$$

## 5.4. Programme in India

The programme implementing agency is Bureau of Energy Efficiency (BEE). In India there is separate programme for fixed speed and variable speed air conditioners. Both of the programmes are under mandatory labelling regime. The following section provides a brief description on both programs:

### Fixed speed air conditioner S&L programme in India

The programme specifies the energy labelling requirements for single-phase split and unitary air conditioners of the vapour compression type for household use up to a rated cooling capacity of 11 kW and that fall within the scope of Indian Standard (IS) 1391 Part 1 and Part 2, being manufactured, imported, or sold in India.

### Test protocols followed

The testing code and procedure for air conditioners is as per IS1391 Part 1 and Part 2 with all amendments. The following parameters are tested as per the requirements:

- Energy consumption
- Cooling capacity

### Star rating bands

The energy efficiency star rating for a model of an AC is determined on the basis of its Energy Efficiency Ratio (EER). The grading bands are shown below:

Star rating	Range of EER (W/W)	
	Unitary type	Split type
1 star	2.5 – 2.69	2.70 – 2.89
2 star	2.70 – 2.89	2.90 – 3.09
3 star	2.90 – 3.09	3.10 – 3.29
4 star	3.10 – 3.29	3.30 – 3.49
5 star	≥ 3.30	≥ 3.50

### Monitoring Verification and Enforcement

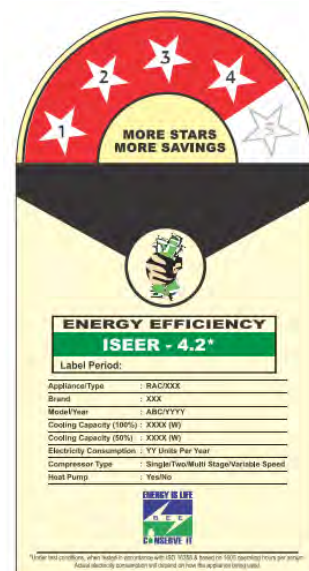
MV&E is done through check testing of all appliances covered under the programme. For example, air conditioner samples are picked up by Bureau of Energy Efficiency (BEE) or its designated agency for testing as per the following sampling plan:

- One sample will be picked up at random from the manufacturing facility or warehouse.
- One sample will be picked from a retail outlet.

Three units of each type shall be picked up for each test. The tests shall be conducted on two of the three units, the third shall be kept as an alternative in case one of the units is damaged or cannot be tested properly for any other reason.

### Labelling fees

- Registration fee is payable on application for assignment of authority is ₹ 1000
- Registration fee is payable on application for renewal of authority to affix labels is ₹ 500



- Labelling fee for affixation of label on each piece of air conditioners is ₹ 30

### **Variable speed air conditioner S&L programme in India**

The programme covers single phase upto & including 250V AC variable capacity air conditioners, commercially known as Inverter air conditioners of the vapour compression type for household and similar use up to and including a rated cooling capacity of 9000 kCal/h.

The test standard referred is ISO 16358-1: 2013 for assessment of cooling seasonal performance factor, in addition with the standards referred in fixed speed air conditioner programme.

The key terminologies used are:

- Cooling Seasonal Energy Consumption (CSEC) – Total annual amount of energy consumed by the equipment when it is operated for cooling in active mode.
- Cooling Seasonal Total Load (CSTL) – Total annual amount of heat that is removed from the indoor air when the equipment is operated for cooling in active mode.
- Indian Seasonal Energy Efficiency Ratio (ISEER) – Ratio of the total annual amount of heat that the equipment can remove from the indoor air when operated for cooling in active mode to the total annual amount of energy consumed by the equipment during the same period.

### **Star rating bands**

Star rating	Range of ISEER (W/W)	
	Minimum	Maximum
1 star	3.10	3.29
2 star	3.30	3.49
3 star	3.5	3.99
4 star	4.00	4.49
5 star	4.50	-

The other details under the programme such as MV&E framework, fees etc. are similar to the programme for fixed speed type air conditioners.

## **5.5. Programme in Singapore**

In 2014, the Government of Singapore introduced the Mandatory Energy Labelling (MELS) for regulated goods to help consumers compare the energy efficiency and make more informed purchasing decisions. Air conditioners are a major component of the scope of the MELS scheme. In addition to the mandatory labelling scheme, air conditioners are also subject to Minimum Energy Performance Standards (MEPS).

### **Scope**

All air conditioners which are single-phase non-ducted room air-conditioner and as per the following criteria are included under the scope:

- 8.8 kW or lower, for casement or window type air-conditioner;
- 17.6 kW or lower, for split type (inverter) air-conditioner; or
- 17.6 kW or lower, for split type (non-inverter) air-conditioner.



## Labelling bands

In order to help consumers better identify the more energy efficient models and spur suppliers to offer more efficient products, the energy rating system for air-conditioners, refrigerators and clothes dryers was revised on 1 September 2014.

The current tick rating is defined on the basis of **COP100% value, defined as “the ratio of total cooling capacity to effective power input at full load cooling capacity”**. For inverter type models, the model shall meet both the minimum COP100% and weighted COP<sup>5</sup>.

Rating	Casement and window (Up to 8.8 kW)	Single split (non- inverter)	Single split (non- inverter)
	Value of COP (W/W)	Value of COP (W/W)	Value of COP (W/W)
<b>1 Tick</b>	$2.90 \leq \text{COP}_{100\%} < 3.78$	-	-
<b>2 Ticks</b>	$3.78 \leq \text{COP}_{100\%} < 4.29$	$3.78 \leq \text{COP}_{100\%} < 4.29$	$3.78 \leq \text{COP}_{100\%} < 4.29$
<b>3 Ticks</b>	$4.29 \leq \text{COP}_{100\%} < 4.86$	$4.29 \leq \text{COP}_{100\%} < 4.86$	$4.29 \leq \text{COP}_{100\%} < 4.86$
<b>4 Ticks</b>	$\text{COP}_{100\%} \geq 4.86$	$\text{COP}_{100\%} \geq 4.86$	$\text{COP}_{100\%} \geq 4.86$
<b>5 Ticks</b>	$\text{COP}_{100\%} \geq 5.50$ <i>Standby power <math>\leq 4 W</math></i>	$\text{COP}_{100\%} \geq 5.50$ <i>Standby power <math>\leq 4 W</math></i>	$\text{COP}_{100\%} \geq 5.50$ <i>Standby power <math>\leq 9 \times N^6</math></i>

Rating	Single-split (inverter)	Multi-split (inverter)
	Value of COP (W/W)	Value of COP (W/W)
<b>1 Tick</b>	-	-
<b>2 Ticks</b>	Weighted COP $\geq 3.78$ COP100% $\geq 3.34$	Weighted COP $\geq 3.78$ COP100% $\geq 3.34$
<b>3 Ticks</b>	Weighted COP $\geq 4.29$ COP100% $\geq 3.78$	Weighted COP $\geq 4.29$ COP100% $\geq 3.78$
<b>4 Ticks</b>	Weighted COP $\geq 4.86$ COP100% $\geq 4.29$	Weighted COP $\geq 4.86$ COP100% $\geq 4.29$
<b>5 Ticks</b>	Weighted COP $\geq 5.50$ , COP100% $\geq 4.86$ <i>Standby power <math>\leq 4 W</math></i>	Weighted COP $\geq 5.50$ , COP100% $\geq 4.86$ <i>Standby power <math>\leq 9 \times N</math></i>

## Existing MEPS levels for air conditioners

Type of air conditioner	Minimum Coefficient of Performance (COP)
<b>Casement and window (Up to 8.8 kW)</b>	$\text{COP}_{100\%} > 2.90$
<b>Single-split (non-inverter)</b>	$\text{COP}_{100\%} > 3.78$
<b>Multi-split (non-inverter)</b>	$\text{COP}_{100\%} > 3.78$
<b>Single-split (inverter)</b>	Weighted COP $> 3.78$ and $\text{COP}_{100\%} > 3.34$
<b>Multi-split (inverter)</b>	Weighted COP2 $> 3.78$ and $\text{COP}_{100\%} > 3.34$

<sup>5</sup> Weighted COP =  $0.4 \times \text{COP}_{100\%} + 0.6 \times \text{COP}_{50\%}$

<sup>6</sup> N = no. of indoor and outdoor units

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## Test standards followed

All air conditioner models are required to undergo the Cooling capacity test and Standby power test as per the following standards:

- ISO 5151:2010 for Casement, window and single-split
- ISO 15042:2011 for Multi-split
- IEC 62301:2005 or IEC 62301:2011 for All (for standby power)

## MV&E

The following MV&E procedure is followed in Singapore:

- Registered suppliers who import or manufacture the following regulated goods are required to register such goods with NEA before they are supplied in Singapore. Registration shall be made online using the ELS Online Portal. The registration requires the **company administrator's SingPass or CorpPass**, test report, and a letter of authorization, if the registration is made by an appointed third-party.
- **The entire database of models registered with the NEA is available in public domain.**
- **The test reports must be provided by laboratories accredited by the Singapore Accreditation Council (SAC), or by other bodies who have a Mutual Recognition Arrangement (MRA) with the SAC,** or in the manufacturer's in-house laboratories.
- The registration of split type air-conditioners shall be accompanied by a declaration of the COP100% values for all combinations of indoor units supplied in Singapore.

# 6. Analysis of global programs for refrigerators

## 6.1. Programme in Hong Kong

The regulation applies to a refrigerating appliance defined in the Ordinance, which includes a refrigerator, frozen food storage cabinet, food freezer, and their combinations for which mains-operated electricity is the primary source of power. However, refrigerators using alternative sources of power, operating by using absorption refrigerating system, or having a rated total storage volume exceeding 500 litres are excluded from the scope of the labelling program.

### Defined compartment types

Compartment type	Definition
<b>“1-star” compartment</b>	a frozen food storage compartment in which the storage temperature measured as described in clause 8.3 of the Code, is not warmer than $-6$ oC.
<b>“2-star” compartment</b>	a frozen food storage compartment in which the storage temperature measured as described in clause 8.3 of the Code, is not warmer than $-12$ oC.
<b>“3-star” compartment</b>	a frozen food storage compartment in which the storage temperature measured as described in clause 8.3 of the Code, is not warmer than $-18$ oC.
<b>“4-star” freezer</b>	a three-star compartment with the added capability of freezing a certain amount of foodstuff which is no less than 4.5 kg per 100 litres, with a minimum of 2.0 kg within 24 hours.

### Classification of refrigerators

Type	Category no.	Functional classification		
		Temperature (fresh food compartment)	Temperature (frozen food compartment)	Description
<b>Refrigerator</b>	Category 1	$5$ °C	N/A	A refrigerator without a frozen food compartment
	Category 2	$5$ °C	$\leq -6$	A refrigerator with a 1-star frozen food compartment
	Category 3	$5$ °C	$\leq -12$	A refrigerator with a 2-star frozen food compartment
	Category 4	$5$ °C	$\leq -18$	A refrigerator with a 3-star frozen food compartment
<b>Refrigerator – freezer</b>	Category 5	$5$ °C	$\leq -18$	A refrigerator with a 4-star frozen food compartment
	Category 6	$5$ °C	$\leq -18$	A Category 5 refrigerator incorporating means to prevent the formation of frost on contents

<b>Freezer</b>	Category 7	N/A	≤ -18	A refrigerating appliance in which the entire storage volume is intended for freezing food.
	Category 8	N/A	≤ -18	A Category 7 refrigerating appliance incorporating means to prevent the formation of frost

### Prescribed tests

The tests specified in this clause are required to be carried out, in accordance with IEC 62552, or other equivalent international standards approved by the Director, in order to find out the energy efficiency and performance characteristics of a refrigerating appliance.

- Measurement of storage temperatures of compartments
- Measurement of storage volumes of compartments
- Energy consumption test
- Freezing test (for only food freezer or refrigerating appliance having food freezer compartment)

### Calculation of energy efficiency

The energy efficiency performance of a refrigerating appliance is defined as the maximum allowable energy consumed per unit storage volume for the storage of food stuff adjusted for the relative contribution to the total energy consumption according to the different temperatures of its compartments with the fresh food storage temperature 5 °C taken as the reference.

$$\text{Refrigerating appliance EER} = \frac{\text{Annual energy consumption (kWh/year)}}{\text{Adjusted volume (L)}}$$

### Energy efficiency grading

The energy efficiency grading is based on a refrigerator's energy consumption index (I), which is defined as the ratio of the actual energy consumption of the refrigerating appliance to the Average Appliance Energy Consumption. The indices are expressed in percentages.

$$\text{Energy consumption index} = \frac{E}{E_{av}} \times 100$$

where E = actual annual energy consumption of the refrigerating appliance

$E_{av}$  = average annual energy consumption as determined from the following table

Category	Average Annual Energy Consumption (kWh/yr)
Category 1	$V_{adj} \times 0.233 + 245$
Category 2	$V_{adj} \times 0.643 + 191$
Category 3	$V_{adj} \times 0.450 + 245$
Category 4	$V_{adj} \times 0.657 + 235$
Category 5	$V_{adj} \times 0.777 + 303$
Category 6	$1.35 \times (V_{adj} \times 0.777 + 303)$
Category 7	Chest freezer: $V_{adj} \times 0.446 + 181$



	Upright freezer: $V_{adj} \times 0.472 + 286$
Category 8	Chest freezer: $1.35 \times (V_{adj} \times 0.446 + 181)$ Upright freezer: $1.35 \times (V_{adj} \times 0.472 + 286)$

The energy efficiency grade for a refrigerator model can be determined through the following table. Grade 1 having the best performance and Grade 5 having the worst performance

Energy Efficiency Grade	Value of I (%)
1	$I \leq 35$
2	$35 < I \leq 44$
3	$44 < I \leq 55$
4	$55 < I \leq 69$
5	$69 < I$

## 6.2. Programme in India

This scheme specifies the energy labelling requirements for electric mains powered Frost Free (No-Frost) refrigerating appliance of the vapour compression type intended for household and similar use being manufactures, imported, or sold in India.

### Test standard followed

This Standard shall be read in conjunction with IS 15750:2006. The following tests are conducted as per the requirements of the labelling scheme:

- Energy consumption
- Rated volume (storage and gross)

### Calculation of Projected Annual Energy Consumption (PAEC)

The process consists of measuring the tested energy consumption ( $E_t$ ) (Appendix K of AS/NZS 4471.1:1997), of each unit tested, then calculating the projected annual energy consumption (PAEC) of the unit.

$$PAEC = E_t * 365/1000 \text{ kWh/year}$$

where  $E_t$  = tested energy consumption expressed in Wh per 24 hours

After testing three or more separate units the separate values of PAEC shall be averaged and referred to as  $PAEC_{av}$ .

### Calculation of Comparative Energy Consumption (CEC)

The nominal energy consumption of a model of refrigerating appliance. It is based on the  $PAEC_{av}$  of the model. The CEC appears on the energy label. Its units are kWh/year.

### Calculation of Total Adjusted Storage Volume For No Frost ( $V_{adj\_tot\_nf}$ )

The rated storage volume of a compartment adjusted to compensate for heat loadings on spaces which are at temperature other than that of fresh food type space. Its calculation is shown below:

Fresh Food Chamber Target Temperature =  $3^\circ \text{C}$

Freezer Chamber Target Temperature =  $-15^\circ \text{C}$

$$\text{Adjusted Volume Factor} = \frac{\text{Test room Temperature} - \text{Freezer Temperature}}{\text{Test rom Temperature} - \text{Fresh Food Temperature}} = 1.62$$

**Total Adjusted Volume for No Frost refrigerator ( $V_{adj\_tot\_nf}$ ) = Fresh Food Storage Volume + 1.62 \* Freezer Storage Volume**

### Determination of star rating

The following equation shall be used to determine the Star Rating Bands for a particular model:

$$\text{Star Rating Band (SRB)} = k_{nf} \times V_{adj\_tot\_nf} + C_{nf}$$

where  $k_{nf}$  = Constant Multiplier (kWh/Litre/Year)

$V_{adj\_tot\_nf}$  = Total Adjusted Storage Volume for No Frost (Litre)

$C_{nf}$  = Constant Fixed Allowance (kWh/Year)

Star rating band	Minimum CEC	Maximum CEC
<b>1 star</b>	$0.3570 * V_{adj\_tot\_nf} + 311$	$0.2856 * V_{adj\_tot\_nf} + 249$
<b>2 star</b>	$\geq 0.2856 * V_{adj\_tot\_nf} + 249$	$0.2285 * V_{adj\_tot\_nf} + 199$
<b>3 star</b>	$\geq 0.2285 * V_{adj\_tot\_nf} + 199$	$0.1828 * V_{adj\_tot\_nf} + 159$
<b>4 star</b>	$\geq 0.1828 * V_{adj\_tot\_nf} + 159$	$0.146 * V_{adj\_tot\_nf} + 127$
<b>5 star</b>	$\geq 0.146 * V_{adj\_tot\_nf} + 127$	

## 6.3. Programme in Thailand<sup>7</sup>

The Green Label has set few environmentally sound criteria based on energy efficiency, use of CFCs substitutes and labelling of plastic types for recycling. It is expected that environmentally sound refrigerators will save electric energy, energy resources, and reduce environmental impacts in Thailand.

To be authorized to carry the Green Label, a product must meet both the general requirements and the specific requirements.



### Scope

This category includes compression-type household refrigerators

### General requirements

- The product must be certified to the Thai Industrial Standard TIS 455, Household Refrigerators or International Industrial Standard or Acceptable Industrial Standard if not certified, must have passed standardized tests of product quality; or must have passed product quality test, as shown in Table 1 of the document.
- The product must be manufactured, transported and disposed in a manner meeting requirements of all applicable governmental acts and regulations

<sup>7</sup> Source: TGL-07-R3-14

### Specific requirements

- The product shall be designated Energy-Saving by carrying the EGAT certified Level 5 refrigerators efficiency label
  - ISO15502 test procedure (or IEC 62552 edition 1).
  - The product must use insulating foaming agent with an Ozone Depletion Potential (ODP) of zero
  - The type and content of plastic material used in the product shall be marked, if the weight of the plastic material is greater than or equal to 50 gram, or if the surface area is greater than or equal to 50 square centimetre.
  - The pigment used in products must not contain all combined heavy metals and organic solvent not exceed than 5% by weight.
  - Noise level emission of products during operation must not exceed than 42 dB(A) and Information about the noise level of the appliance shall be provided in a way clearly visible to the consumer
  - Plastic parts heavier than 25 grams shall not contain the following flame retardants as stated in table 2 of the document
- **The product must use refrigerant with an Ozone Depletion Potential (ODP) of zero**

## 6.4. Programme in Singapore

The Mandatory Energy Labelling Scheme (MELS) is applicable to all Regulated Goods for sale in Singapore. Refrigerators with an adjusted volume of up to 900 litres come under the ambit of the MELS. In addition, MEPS apply to household refrigerators since 2011. The MEPS regime has since been updated with certain amendments in 2013 and 2015 to make the energy efficiency criteria more stringent.<sup>8</sup>

The National Environmental Agency (NEA) is responsible for implementation of the MELS scheme.

### Scope

All residential refrigerators with an adjusted volume upto 900 L.

### Test procedure

- ISO15502 test procedure (or IEC 62552 edition 1)
- Energy efficiency test at **ISO Tropical temperature of 32°C**

### MEPS levels

The MEPS of a refrigerator is determined as an annual energy consumption (AEC in kWh) using the adjusted volume.

The applicable equations and limit are as follows (for adjusted volume up to 900 litres):

- Refrigerator (without freezer):  **$368 + (0.892 \times V_{adj}) \times 0.64$**
- Refrigerator (with freezer):  **$465 + (1.378 \times V_{adj}) \times 0.585$**

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<sup>8</sup> Source: <http://www.nea.gov.sg>

- Refrigerator- with freezer with through the door ice (TTD): **585 + (1.378 × Vadj) x 0.560**

**Vadj** is the adjusted volume and is calculated as follows:

- $V_{adj} = K_c \times \text{Actual volume of the compartment}$

**K<sub>c</sub>** is the volume correction factor for a particular type of compartment and is defined as follows:

Compartment Type	Volume Correction Factor
<b>Fresh Food</b>	1.00
<b>4 star freezer</b>	1.79
<b>3 star freezer</b>	1.79
<b>2 star freezer</b>	1.57
<b>1 star freezer</b>	1.36
<b>Chill</b>	1.13
<b>Cellar</b>	0.75

### Label grading scheme<sup>9</sup>

The tick mark levels are defined as follows:

Type	Annual Energy Consumption (AEC) in kwh			
	1 Tick	2 Ticks	3 Ticks	4 Ticks
<b>Without freezer</b>	$[(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.551] \geq \text{AEC} > [(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.461]$	$[(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.461] \geq \text{AEC} > [(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.332]$	$[(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.332] \geq \text{AEC} > [(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.239]$	$[(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.239] \geq \text{AEC}$
<b>With freezer (Vadj tot ≤ 300 litres)</b>	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.553] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.427]$	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.427] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.312]$	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.312] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.228]$	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.228] \geq \text{AEC}$
<b>With freezer (Vadj tot &gt; 300 and ≤ 900 litres)</b>	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.506] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.427]$	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.427] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.312]$	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.312] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.228]$	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.228] \geq \text{AEC}$
<b>With freezer, through-the-door ice dispenser</b>	$[(585 + 1.378 \times V_{adj} \text{ tot}) \times 0.485] \geq \text{AEC} > [(585 + 1.378 \times V_{adj} \text{ tot}) \times 0.409]$	$[(585 + 1.378 \times V_{adj} \text{ tot}) \times 0.409] \geq \text{AEC} > [(585 + 1.378 \times V_{adj} \text{ tot}) \times 0.298]$	$[(585 + 1.378 \times V_{adj} \text{ tot}) \times 0.298] \geq \text{AEC} > [(585 + 1.378 \times V_{adj} \text{ tot}) \times 0.218]$	$[(585 + 1.378 \times V_{adj} \text{ tot}) \times 0.218] \geq \text{AEC}$

<sup>9</sup> Source: <http://www.nea.gov.sg>

## 7. Analysis of global programs for washing machines

Washing machines (or clothes washers, including combination washer/dryers) are one of the most popular appliances for which energy efficiency policies such as Minimum Energy Performance Standards (MEPS) and energy labelling are both mandatory and voluntary. As per the CLASP S&L database, MEPS and/or labelling programs for washing machines are presently active in approximately 27 countries/regions, which include the US, the EU, South Korea, Japan, Australia, and New Zealand.

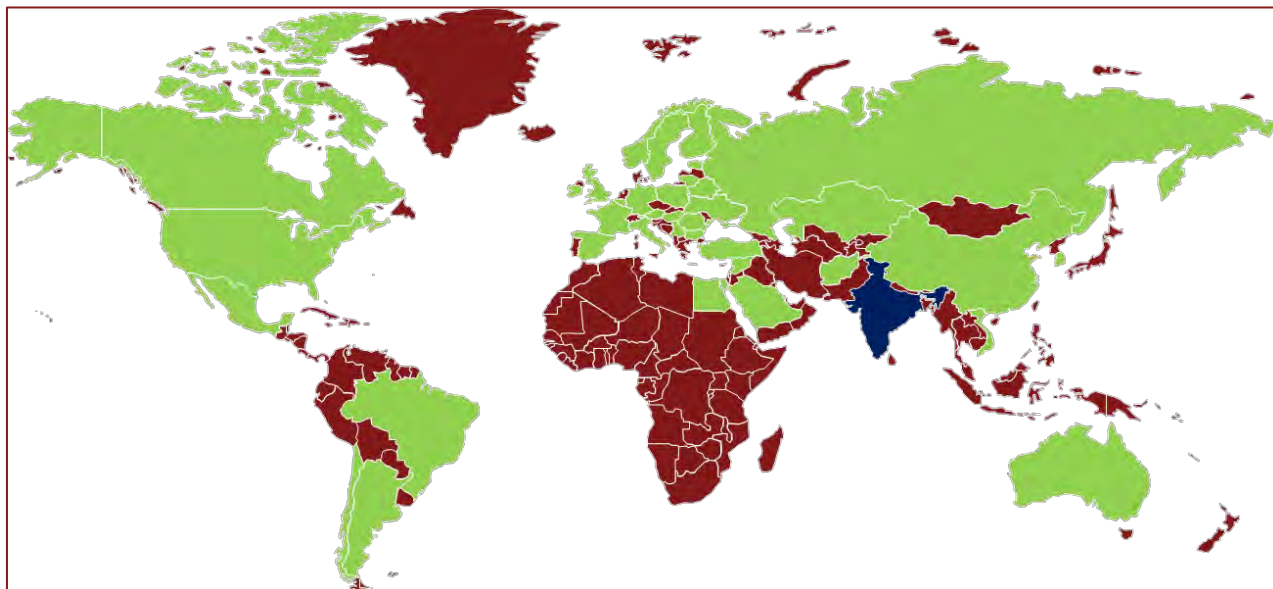


Figure 4: Countries with active energy efficiency programs for washing machines

Most MEPS or labelling programs for clothes washers cover the two predominant types of washing machines—horizontal axis and vertical axis. **Horizontal axis machines are also known as front-load or drum type washing machines**, while the **vertical axis washers include more traditional types of vertical impeller or agitator machines and top-loading washing machines**.

The type of washing machine that dominates the market varies in each country and, as a result, the scope of standards and labels and national test procedures reflect national or regional market differences. For example, **Korea's MEPS and mandatory energy label only apply to horizontal drum washing machines**, while **Japan**, which does not have specific requirements for energy use, has a test standard specific to vertical impeller machines.

Although the EU market is dominated by horizontal drum washing machines, its mandatory energy information label has a broader scope that excludes only special types such as manual washing machines with no spin capability and washer-dryer combination machines.

A summary of active programs for washing machines for major regions across the globe is provided in Table 1.<sup>10</sup>

<sup>10</sup> Source: CLASP S&L database (accessed on 4 August 2017)

Table 1: Major labelling programs for washing machines

Region	Washing machine types in the market	Policy type	Mandatory/voluntary	Scope
<b>Australia</b>	<i>Information not available</i>	Label comparative	Mandatory	Clothes washer
<b>Canada</b>		Label comparative	Mandatory	Clothes washer
		MEPS	Mandatory	Combination clothes washer-dryer
		MEPS	Mandatory	Clothes washer
		Label endorsement	Voluntary	Clothes washer
<b>China (PRC)</b>	Front loaders	Label comparative	Mandatory	Clothes washer
	Semi-automatic top loading impellor machines	MEPS	Mandatory	Clothes washer
		Label endorsement	Voluntary	Clothes washer
<b>EU</b>	Front loaders	Label comparative	Mandatory	Combination clothes washer-dryer
		Label comparative	Mandatory	Clothes washer
		MEPS	Mandatory	Clothes washer
<b>Hong Kong</b>	Front loaders Semi-automatic top loading impellor machines	Label comparative	Mandatory	Clothes washer
<b>Korea (ROK)</b>	<i>Information not available</i>	Label endorsement	Voluntary	Clothes washer
		MEPS	Mandatory	Clothes washer
		Label comparative	Mandatory	Clothes washer
		MEPS	Mandatory	Clothes washer
		Label comparative	Mandatory	Clothes washer
<b>New Zealand</b>	<i>Information not available</i>	Label endorsement	Voluntary	Clothes washer
		MEPS	Mandatory	Clothes washer
		Label comparative	Mandatory	Clothes washer
<b>Thailand</b>	<i>Information not available</i>	Label endorsement	Voluntary	Clothes washer
		Label comparative	Voluntary	Clothes washer
<b>UAE</b>	<i>Information not available</i>	Label comparative	Mandatory	Clothes washer & dryer
<b>United States</b>	Fully automatic top & front loaders	Label endorsement	Voluntary	Clothes washer
		MEPS	Mandatory	Clothes washer

Among various S&L programs mentioned in the table above, a review of the S&L programmes in China, Thailand, Hong Kong and the UAE was undertaken, a summary of which is provided in the next section.

## 7.1. Programme in China

China introduced a mandatory labelling programme for washing machines in 2007, which was based on GB12021-2004 and was valid until October 2013. The washing machine labelling program is currently based on GB12021-2013. The energy label sample of washing machines shown here includes information on **energy consumption** and **water consumption** of a washing cycle, **washing effectiveness** and **the rated washing capacity** of the washing machine. China's NDRC and AQSIQ are responsible for its implementation.

### Technologies available in China's market

There are two main technologies of washing machines: drum (front load) and impeller (top load). Twin-tub washing machines were popular in the 1980s and 1990s. However, this type holds only a small market share in rural areas today.

Although the prices of drum washing machines are much higher than those of impeller washing machines, drum washing machines are becoming more popular than impeller washing machines in China. 49% of the washing machines on the Chinese market are drum washing machines, 48% are impeller washing machines and 3% are twin-tub washing machines.<sup>11</sup>

### Typical usage pattern

Most Chinese families do their washing in cool or cold water that comes directly from the pipe. Apartments very rarely have pressurized warm water supply. So, data on typical washing temperature is very limited. The washing frequency differs widely because of the different family sizes and washing habits.

### Test standards followed

The testing standard for washing machines is defined in the national standard, entitled GB/T 4288- 2008 household and similar electrical washing machine. The testing method measures the same performance variables for both types of washing machines, including energy consumption, water consumption and washing quality. However, the testing conditions for the two types of machines have significant differences:

- Impeller machines are tested using cool water at  $30 \pm 2$  °C. Water is heated from ambient temperatures to the test temperature externally, and the energy used to heat the water is not included in the declared energy consumption. This corresponds to the requirements of JIS 9606.
- Drum washing machines are tested using hot water. For units with an integrated water heater, the washing machine is filled with cold water of  $15 \pm 2$  °C and run at the default standard hot washing setting. For units without an integrated water heater, the washing machine is filled with hot water at  $50 \pm 2$  °C. Again, this water is heated from ambient to target temperature externally and the energy used to heat the water is not included in the declared energy consumption. This corresponds to the requirements of IEC 60456.

### Labelling criteria

GB12021.4-2013 defines five energy efficiency tiers for washing machines. Energy consumption per kilogram, water consumption per kilogram and rate of washing effectiveness are the three parameters to define the energy



<sup>11</sup> Source: Market research of Top10, January 2014

efficiency tiers of the washing machine. Tier 5 corresponds to the MEPS and Tier 1 is the most efficient. **Machines corresponding to Tier 1 and Tier 2 are eligible for the voluntary endorsement label.**

The requirements for impeller type washing machines and drum type washing machines are maintained differently due to their different test procedures and requirements.

EE tier	Top load (impeller type)			Front load (drum type)		
	Electricity use (max) KWh per cycle per kg	Water use (max) L per cycle per kg	Cleaning performance (min)	Electricity use (max) KWh per cycle per kg	Water use (max) L per cycle per kg	Cleaning performance (min)
1	0.011	14	0.90	0.11	7	1.03
2	0.012	16	0.80	0.13	8	1.03
3	0.015	20	0.80	0.15	9	1.03
4	0.017	24	0.80	0.17	10	1.03
5	0.022	28	0.80	0.19	12	1.03

### Calculation of energy and water consumption per cycle

Launched in 2004, the first energy efficiency standard was based on GB/T 4288-2003 and promulgated under GB 12021.4-2004, under which energy and performance consumption values were determined at full load for a given test machine.

However, the revised standard GB 12021.4-2013, implemented since 2013, adds the half-load test in the process of measuring energy consumption per kilogram and water consumption per kilogram. The formula for determination of energy consumption per kilogram is reproduced below:

$$E_e = I_e \times \frac{E_1 + 2E_2}{2m}$$

$E_e$  = Energy consumption per kg  
 $I_e$  = Energy efficiency compensation coefficient (0.75 for impeller, 0.85 for drum)  
 $E_1$  = Energy consumption at full load  
 $E_2$  = Energy consumption at half load  
 $m$  = rated capacity (in kg)

The formula to determine water consumption per kg is reproduced below:

$$W_e = I_w \times \frac{W_1 + 2W_2}{2m}$$

$W_e$  = Water consumption per kg  
 $I_w$  = Water efficiency compensation coefficient (0.75)  
 $W_1$  = Water consumption at full load  
 $W_2$  = Water consumption at half load  
 $m$  = rated capacity (in kg)



## 7.2. Programme in Thailand

A voluntary endorsement labelling program for washing machines has been active in Thailand since 2007. The label, called the “Green Label” is awarded to those models with low water and energy consumptions.

The green label program applies to washing machines for household use and similar functions, used with alternate currents of not more than 250 volts for single phase, and not more than 480 volts for 3 phase, either with or without heating equipment, providing hot or cold washes, including combination washer dryers.

Washing machines not intended for household use are also included under this program.



### Minimum requirements

Parameter	Requirement			
Wash performance (%)	Minimum 80%			
Cold wash energy consumption (Wh/kg) <i>If machine is not capable of performing washes with hot water</i>	<b>6 kg</b>	<b>7-8 kg</b>	<b>9-10 kg</b>	<b>11-12 kg</b>
	≤ 25	≤ 20	≤ 16	≤ 13
Hot wash energy consumption (kWh/kg)	≤170			
Amount of water consumed (L/kg)	<b>6 kg</b>	<b>7-8 kg</b>	<b>9-10 kg</b>	<b>11-12 kg</b>
	≤ 28	≤ 26	≤ 24	≤ 22
Noise in dB (A)	<b>While washing</b>		<b>While drying</b>	
	≤ 50		≤ 55	

### Other requirements

The technical documentation TGL-13-R1-07 specifies that no halogens be used in synthetic resins in components weighing more than 25 grams, except electrical cords and electronic parts.

Further, if fire retardants are used in synthetic resins weighing more than 25 grams which is a component for the drum, the product must be made from materials which does not have additives such as Polybrominated biphenyls (PBBs), Polybromodiphenyl Ethers (PBDEs), and short-chain Chlorinated Paraffins (C=10-13) which consist of more than 50 percent of fire-retardant Chlorine.

### Prescribed test methods

Testing for characteristics, safety, and competency of the washing machine, as well as testing for electricity and water consumption shall be in accordance with the Thai Industrial Standard for Clothes Washing Machines for Household Use, TIS 1462. *We believe TIS 1462 is mostly aligned with IEC 60456 for front loading washing machines and JIS C 9606 for vertical axis washing machines. However, analysis of TIS 1462 is not possible at this stage due to language barriers.*

Measurements of electricity and water consumption shall be done under the same testing conditions as the test for competency of cleaning, washing, and spin-drying (if available) of the washing machines.

Testing for noise shall be in accordance with JIS C 9606 no. 8.7 or EN 60704-2-4, or other acceptable national standards.

## 7.3. Programme in Hong Kong

The government of Hong Kong introduced the Mandatory Energy Efficiency Labelling Scheme (MEELS) through the Energy Efficiency (Labelling of Products) Ordinance, Cap. 598. Under MEELS, energy labels are required to be shown on the prescribed products for supply in Hong Kong to inform consumers of their energy efficiency performance.

Washing machines were added under the Ordinance first in 2010, and the requirements were modified subsequently in 2013.

### Parameters displayed

- Energy efficiency grade
- Annual energy consumption (kWh/year)
- Washing capacity (kg)
- Water consumption (L)
- Model & brand details



### Minimum requirements

Parameter	Horizontal axis washing machines	Vertical axis washing machines
Test standard followed	IEC 60456	JIS C 9606
Washing performance	≥ 70%	C ≥ 0.55
Water extraction performance	Remaining moisture content ≤ 1.1	Water extraction efficiency ≥ 0.47

If a machine does not adhere to the above requirements, it is deemed ineligible for Labelling grades 1 to 4.

### Prescribed test methods

The energy and water performance tests are to be carried out as per IEC 60456 for horizontal-axis washing machines and JIS C 9606 for vertical-axis washing machines. For horizontal-axis washing machines, the 60°C cotton programme is used without pre-wash. For vertical-axis washing machines, the temperature of water is 30±2°C.

A test report submitted by a manufacturer must consist of the following information:

- Energy consumption
- Water consumption
- Washing performance
- Water extraction performance

### Energy efficiency grading scheme

A washing machine model is given an energy efficiency grade from 1 to 5, with 1 being the best and 5 the worst. The energy efficiency grade of a model is determined on the basis of its specific energy consumption.

The grading scheme is shown below:

Energy efficiency grade	Specific energy consumption (KWh/kg/cycle)	
	Horizontal axis type	Vertical axis type
1	≤ 0.130	≤ 0.0160
2	0.130 to 0.150	0.0160 to 0.0184
3	0.150 to 0.172	0.0184 to 0.0208
4	0.172 to 0.195	0.0208 to 0.0232
5	> 0.195	> 0.0232

### Calculation of specific energy consumption

The specific energy consumption of a washing machine is calculated as follows:

- For horizontal axis washing machine with built-in water heating device and vertical axis washing machine, the specific energy consumption is calculated as follows:

$$\text{Specific Energy Consumption (E}_{sp}\text{)} = \frac{E}{W_r}$$

where E = measured energy consumption per cycle (kWh/cycle)

and W<sub>r</sub> = rated washing capacity (kg)

- For horizontal axis washing machine without built-in water heating device, the specific energy consumption is calculated as follows:

$$\text{Specific Energy Consumption (E}_{sp}\text{)} = \frac{E+W_h}{W_r}$$

where E = measured energy consumption per cycle (kWh/cycle)

W<sub>h</sub> = calculated hot water energy (kWh/cycle)

and W<sub>r</sub> = rated washing capacity (kg)

- The calculated hot water energy is the theoretical energy requirement for heating water from 15° C to 60° C and shall be calculated as follows:

$$W_h = \frac{V_h \times (60 - 15)}{860}$$

where V<sub>h</sub> = the volume of external hot water used in litres during the operation

### MV&E

The key aspects of MV&E practices in Hong Kong (considering refrigerator as a sample case) are shared below:

- The governing law is the Energy Efficiency (Labelling of Products) Ordinance that was passed in May 2008. The products that come under the purview of the ordinance are mentioned in its Annexures.
- The ordinance specifies that the Director of Electrical and Mechanical Services Department (the Director) is responsible for the enforcement of the scheme.

- The programme has a self-certification system wherein the manufacturers and importers are required to register all products covered by the programme before they can be sold. An application for registration and necessary documents must be submitted to the Director.
- The Director provides the authority to affix the label based on the information submitted by the applicants and conducts verification and enforcement checks post labelling. The Government of Hong Kong has published a Code of Conduct to guide stakeholders for discharging their duties.
- The Director is authorised to conduct compliance monitoring in order to verify the claims made by manufacturers and importers through verification testing. The samples of products are arranged from the market. The procedure is mentioned in the Code of Conduct.
- Where a product fails an initial screen test on a single sample, a further set of tests on multiple (usually three) samples is used to confirm the non-conformance of the model.

### Other requirements

In addition to the energy efficiency performance requirements, all washing machines must comply with the Electrical Products (Safety) Regulation, Chapter 406G of the Laws of Hong Kong, and the safety standards specified under the Regulation, and all other legislations concerning the safety of the washing machines.

## 7.4. Programme in UAE

ESMA through the “Technical Committee for Energy Efficiency and Labelling for Washing Machines and Dryers” has prepared the standard UAE.S 5010-2:2012 Labelling – Energy Efficiency for Electrical Appliances Part 2: Washing Machines and Dryers.

This regulation is developed to ensure that washing machines and dryers are registered and monitored for their continuous compliance to the set specifications on

- Energy consumption
- Water consumption
- Spin Extraction Performance for Washing Machines
- Condensation Efficiency for Condenser Dryers



### Scope

This regulation deals with methods for measuring the energy and water consumption of clothes washing machines for household use, with or without heating devices and for cold and/or hot water supply. It also deals with appliances for water extraction by centrifugal force and is applicable to appliances for both washing and drying textiles (washer-dryers).

The document also applies to washing machines for communal use in block of flats or in launderettes up to 20kg capacity. Washing machines intended for commercial purposes are not included.

### Test conditions

In carrying out the tests as specified above, the unit shall be tested at a voltage of 230V±1% and a frequency of 50Hz±1%.

The 60°C cotton program shall be used without pre-wash in accordance with the manufacturer's instruction; if it's not there the manufacturer can declare it. And the cold water temperature should be 25±2°C.

In cases of washing machines without any programs, the recommended times for Washing, rinsing, and spin extracting operations shall be in accordance with the manufacturer's instructions for the rated washing capacity to be tested.

### Test standards

The tests specified in this regulation are required to be carried out, in accordance with UAE.S IEC to find out the energy efficiency and performance characteristics of a washing machine and dryer with hard water.

The tests are required to be carried out, in accordance with:

- UAE.S IEC 60456: 2010
- UAE.S IEC 61121:2012
- UAE.S IEC 62512:2012

### Measurement of Water Consumption

The water consumption (liters/cycle) shall be measured during the energy consumption test in accordance with UAE.S IEC 60456: 2010 and UAE.S IEC 62512:2012.

This maximum water consumption allowable is as per the following formula:

- For drum type →  $WC \leq (5 * C + 35)$  Litres
- For top loading type →  $WC \leq (20 * C + 35)$  Litres

Where C = washing capacity (kg) & WC = the water consumption of the default 60°C declared standard cycle (Litres)

### Energy Efficiency Classes

The energy efficiency class of a household washing machine shall be determined in accordance with its Energy Efficiency ratio (EER), which is defined as:

$$EER = \frac{E}{CR}$$

Where E: average of energy consumption for two units for average of three cycles for each unit

C: rated capacity of the unit (kg)

EE class	Range of EER values (Wh/kg)	
	Drum type	Top load & twin tub types
<b>5 star</b>	EER < 90	EER < 14
<b>4 star</b>	90 ≤ EER < 110	14 ≤ EER < 17
<b>3 star</b>	110 ≤ EER < 130	17 ≤ EER < 20
<b>2 star</b>	130 ≤ EER < 150	20 ≤ EER < 23
<b>1 star</b>	150 ≤ EER < 170	23 ≤ EER < 26

## Spin drying efficiency Classes

The spin drying efficiency class is determined in accordance with the Remaining Moisture Content (RMC), which is determined as shown below:

$$RMC = \frac{M_r - M}{M} \times 100$$

where M: mass of the conditioned load.

Mr: mass of the loose load after spin extraction

Spin drying efficiency class	RMC (%)
<b>5 star</b>	RMC < 50
<b>4 star</b>	50 ≤ RMC < 60
<b>3 star</b>	60 ≤ RMC < 70
<b>2 star</b>	70 ≤ RMC < 80
<b>1 star</b>	80 ≤ RMC < 90

## 7.5. Programme in Singapore<sup>12</sup>

The PUB (Singapore's National Water Agency) started the Mandatory Water Efficiency Labelling Scheme (WELS) in 2009 to increase the efficient use of water in the country. In 2017, the Mandatory WELS scheme was extended to cover washing machines.

The grading in the label is conducted in the form of Ticks – with 1 Tick provided to the least efficient product, and 4 Ticks to the most efficient product.



### Labelling criteria

The label grade is determined on the basis of the washing machine model's water factor – ratio of wash volume in L and its wash capacity in kg.

Water efficiency class	Range of Water factor (WF)
<b>1 Tick</b>	-
<b>2 Ticks</b>	9 < WF ≤ 12 L/kg
<b>3 Ticks</b>	6 < WF ≤ 9 L/kg
<b>4 Ticks</b>	WF ≤ 6 L/kg

**A water factor of 12 L/kg is the maximum allowed for the attaining the label.**

<sup>12</sup> Source: WELS Products, accessed on 20 February 2018

# 8. Regulatory assessment for implementation of S&L program

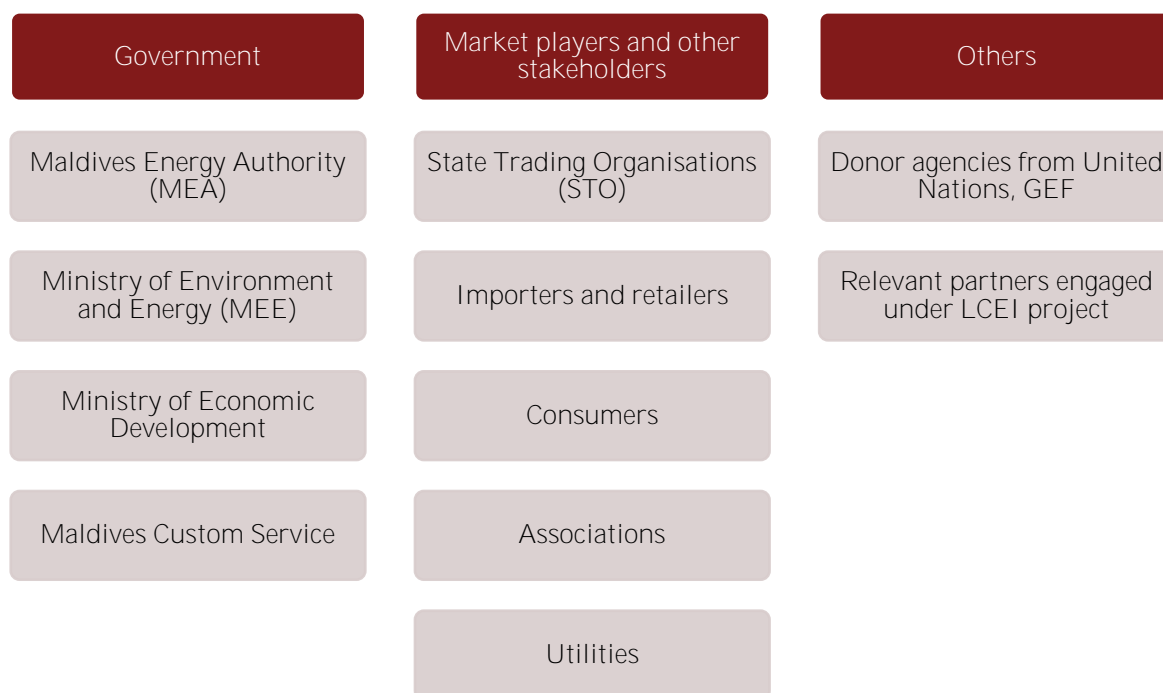
## 8.1. Overview on key stakeholders

An important requirement for developing an energy labelling programme is to identify relevant stakeholders and form stakeholder committees to provide input that will help officials (from program implementing body) develop the program.

The figure below provides information on key stakeholders' of the program in general irrespective of the type of equipment and geographical location.



In Maldives, following are the key stakeholders that have an important role to play in development and implementation the energy efficiency standards and labelling programme:



An important requirement under the labelling programme is to define the roles and respective functions for each stakeholder. A brief overview on the proposed roles is shared below. This will be further discussed with respective stakeholders and revised.

S. No.	Stakeholders	Description
1.	Ministry of Environment and Energy (MEE)	<b>The MEE is the apex body responsible for the Government's</b> environmental, energy and climate policy. The Ministry works on issues concerning the climate, energy, biological diversity, chemicals, ecocycles, nature, marine and water environments and international environmental cooperation.
2.	Maldives Energy Authority (MEA)	MEA is the nodal agency for introduction of new standards in the country. MEA is currently in-charge for implementing S&L program for appliances and equipment. MEA will be the main agency to execute this programme
3.	Ministry of Economic Development	The ministry oversees all activities and matters related to trade and the economy. The functions of the ministry include the registration of different types of businesses, investments, companies and intellectual properties among other trade related entities
4.	Maldives custom service	Responsible for inspection of imported equipment and check the presence of necessary documentation as well as compliance with the locally required regulations
5.	Importers	Import of product for sale in Maldives
6.	Utilities	To supervise, and control all the matters related to the electric power activities which have a direct impact on availability and supply of power, environmental protection, and interests of consumers.
7.	Donors	These are various multilateral and bilateral organizations working to promote adoption of energy efficiency policies & measures in Maldives

## ***8.2. Overview on existing mandate for S&L***

MEA is the governing body for implementation of S&L programme. The mandate for MEA is shared below:

- Advise the Government on energy related issues and assist the Government on making decisions concerning the energy sector;
- **Set standards and regulations, in accordance with the Government's energy policy, to regulate the energy sector;**
- Formulate and implement a code, regulation and standards to regulate the production and consumption of energy in the Maldives;
- **Set standard for the energy resources imported, sold or consumed in the Maldives;**
- Issue permits to utility (electricity) service providers; set tariff principles (approving tariff for the suppliers); issuing permits to generate electricity for private use; and monitoring their compliance with regulations;
- Issue licenses to power engineers; setting criteria for power engineering consultants;
- Resolve conflicts between electricity suppliers and consumers, arising from the infringement of agreements signed between them;



- Collect and maintain statistics on energy production and consumption in the Maldives; energy need assessment; collect information and conduct research on this; and publish the outcomes.
- **Implement Law No. 4/96 “Public Utilities Act” to regulate the electricity services in Maldives.**

The mandate empower MEA to formulate energy standards and also make regulations for enforcement of standards. However, the aspects such as monitoring and verification of the standards /regulation needs to be assessed. Also, the power for penalising the defaulters along with its respective mechanism needs to be evaluated.

Be it S&L or any other energy efficiency programme one of key requirement is to define the framework for monitoring and verification. In the case of Maldives which is an import driven economy it would be important to capture this aspect within the existing mandate of MEA in consultation with local stakeholders.

Another aspect is to create a sustainable robust team structure for implementation of the programme. The standards and labelling has various sub-components which require a complete team effort for successful implementation. It is important to assess the existing the existing institutional capacity within MEA and identify gaps which needs to be overcome before beginning of programme implementation.

In the following section, some of the key aspects which needs to be evaluated for Maldives in terms of institutional and regulatory capacity is presented.

### **8.3. Institutional analysis**

The institutional capacity assesses the capacity of country to formulate and successfully implement energy efficiency policies. Strong institutional capacity is critical to ensuring the effectiveness of energy efficiency policies and programs. For developing energy efficiency standards & labelling program it is important to evaluate the existing resources and institutional capacity and how these factors are likely to influence the adoption and effectiveness of the program.

In particular, the S&L programs require adequate personnel, institutional and financial resources for effective implementation. Following is a brief summary of the institutional assessment for implementing the S&L program for selected appliances at Maldives.

<b>Institutional requirements for implementing S&amp;L programme</b>		<b>Status at Maldives</b>	<b>Needs /next action</b>
<b>Assessment of implementing body (MEA)</b>			
1.	Properly laid institutional structure with clear roles, responsibilities & authorities for the personnel within the implementing organization	There is an institutional structure. At present, only one resource has been earmarked with S&L responsibility.	This needs to be strengthened
2.	Availability of sufficient personnel (technical professionals to implement & inspect the program)		
<b>Assessment of implementation capacity</b>			
3.	Standard guideline that describes the rules & process flow for implementing the S&L program		
4.	For an effective consultation between stakeholders it is important to have a national level committee (forum on energy efficiency),		

	comprising defined representatives from these stakeholders. Is there any such committee in Maldives to deliberate on S&L program requirements? If yes, whether the powers & responsibility of such committee is legally defined?		
5.	Mechanism for evaluation of potential energy savings for the nation through introduction of S&L programme		
6.	Is there a need for financial assistance during start of the program?		
7.	Financial resources needed for implementation of S&L program		
<b>Monitoring Verification &amp; Enforcement</b>			
8.	Provision for maintaining record of equipment specific technical & sales data after the launch of S&L program		
9.	Guideline for undertaking monitoring, verification & enforcement (MV&E) activities for the S&L program		

## 8.4. Regulatory analysis

Following is a brief summary of the regulatory assessment for implementing the S&L program for selected appliances at Maldives.

	<b>Regulatory requirements for implementing S&amp;L programme</b>	<b>Status at Maldives</b>	<b>Needs /next action</b>
1.	Availability of legislation to regulate appliance market		
2.	Availability of nationalized test protocols / procedure for the equipment under consideration (air conditioner, refrigerator and washing machine)		
3.	Provision of legal actions and its process that are required in case of non-conformance with regulatory norms		

*The requirements mentioned in the institutional and regulatory analysis is a form of questionnaire. During the inception workshop and the stakeholders' discussion followed by it, the project team in consultation with LCEI project officials will evaluate the status of institutional and regulatory capacity in Maldives. The ultimate purpose will be to arrive at realistic recommendations for Maldives.*

## 9. Project review discussions

### 9.1. Minutes of discussion between officials from LCEI project, MEA & PwC

Participants	Date and time	Medium
Mr. Mohamed Inaz, LCEI Project Manager, MEE	23 January 2018	WebEx call
Ms. Fathimath Roufa Moosa, LCEI Project M&E Officer, MEE	12:30 to 13:00 (MVT)	
Ms. Shara Mauroof Ahmed, S&L Officer, MEA		
Mr. Rajeev Ralhan, Director, PwC		
Mr. Mohit Verma, Manager, PwC		
Mr. Jwalant Mehta, Consultant, PwC		

A WebEx call was scheduled between the officials from LCEI Project – MEE, MEA and PwC on 23<sup>rd</sup> January 2018. The agenda of the discussion **was to review the project’s progress since the signing of the contract for development** of S&L programme in the Maldives. The work on the inception report and the planning for inception workshop was also discussed.

A summary of key points discussed over the call is shared below.

- Rajeev informed that the team is in the process of review of international standard & labelling programs for the 3 appliances. The countries included in the assessment were selected on the basis of their relative shares in the total imports in the Maldives.
- He also shared that the team will share questionnaires meant for data collection from importers with MEA by Wednesday, 24<sup>th</sup> January. He requested the MEA officials to circulate those with the appropriate persons prior to the inception workshop.
- Rajeev confirmed that the project team shall share the inception report by 30<sup>th</sup> January 2018, as agreed during the project commissioning in Male. In the inception report the team will capture key stakeholders and respective data needs. It was proposed that based on this MEA shall initiate communication with local stakeholders to seek relevant data.
- The project team proposed to conduct the inception workshop on 7<sup>th</sup> February 2018. Mr. Inaz confirmed that the workshop can take place on the 7<sup>th</sup> of February.
- The project team enquired about the existing energy/electricity laws in the Maldives, and the role/responsibility & jurisdiction of the MEA. Mr. Inaz informed that the Presidential Decree for MEA **illustrated MEA’s responsibilities and the in-progress** Electricity Act will empower MEA to do the same. As the Act is not yet passed, it is not available in English.
- Mr. Inaz also informed that MEA has identified the focal points in key agencies such as Customs so that key discussions could be held once the team arrives in Male.

At the conclusion, the team thanked LCEI project and MEA personnel for their inputs and support.

# 10. Agenda for inception workshop



**MALDIVES ENERGY AUTHORITY**  
GOVERNMENT OF MALDIVES

## **Inception Workshop** **Development and Implementation of Energy Efficiency Labelling** **Programme in the Maldives**

### **Draft Agenda**

**Date: 07<sup>th</sup> February 2018**  
**Venue: Auditorium**

<b>Time</b>	<b>Topic</b>	<b>Speaker</b>
<b>0900-0930</b>	<b>Session 1: Inaugural</b>	
	Introductory remarks and purpose	MEA, MEE
	Importance of S&L	Rajeev Ralhan, PwC
<b>0930-1000</b>	<b>Tea</b>	
<b>1000-1100</b>	<b>Session 2: Preparation for S&amp;L program in Maldives</b>	
	Overview of key tasks that will be undertaken in this project	Mohit Verma, PwC
	Overview of selected international S&L programs	Mohit Verma, PwC
<b>1100-1200</b>	<b>Session 3: Data needs and next action</b>	
	Role of stakeholders	Rajeev Ralhan, PwC
	Stakeholder specific data needs	Rajeev Ralhan, PwC
	Brainstorming on identifying approaches for developing S&L for selected appliances	Combined
<b>1200-1300</b>	<b>Lunch</b>	

#### **Participants;**

- Maldives Energy Authority (MEA)
- Ministry of Environment and Energy (MEE)
- Ministry of Economic Development (MED)
- Maldives Customs Services (MCS)
- State Trading Organization Plc. (STO)

**Supported by:** Strengthening Low Carbon  
Energy Island Strategies (LCEI) Project



# 11. Work schedule

We are here



No.	Activities	Duration in Weeks																																				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34			
1.	Project inception meeting	█	█	█	█																																	
	Conduct of a round table discussion			█	█																																	
2.	Develop recommendation for an EE labelling programme			█	█	█	█	█	█																													
	Review and compare labelling scheme of countries from which selected appliances are imported into Maldives	█	█	█	█																																	
	Recommend energy efficiency levels for labelling scheme to categorize the selected appliances available in Maldives market, and its equivalence for labels issued by exporting countries				█	█	█	█																														
	Recommend label format and information for labelling scheme in the Maldives							█	█																													
3.	Recommend EE labelling programme implementation procedure								█	█	█	█	█	█	█	█	█	█																				
	Recommend a process of implementing Maldives EE Labelling Programme, based on certification issued for labelling and documentations used for certification in exporting country.								█	█	█																											
	Recommend process and approaches for establishing collaborative arrangements with labelling authorities of key exporting countries for verification of submissions to Maldives EE Labelling programme									█	█	█																										
	Recommend process and procedures for importing the products into the country and process for Customs officials to approve the imports										█	█	█																									
	Recommend process to confirm general quality of appliances to be labelled to ensure counterfeits cannot be imported into the country											█	█	█																								
	Revise the draft energy labelling regulation to cater for the implementation of the Maldives EE labelling programme												█	█	█																							
4.	Framework to monitor implementation of the EE labelling programme									█	█	█	█	█	█	█	█	█																				
	Recommend process and procedures for market surveillance to ensure effective implementation of the EE Labelling Programme										█	█	█																									
	Review the existing roles & responsibilities of Government entities on market surveillance and recommend necessary amendments to include the roles and responsibilities for Market Surveillance											█	█	█																								
	Demonstration of market surveillance process and procedure to the relevant government entities												█	█	█	█	█																					



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Note: During the inception meeting (post workshop), the work plan will be discussed in detail with contracting authority. Our experience suggests that there could be a few minor revisions in the workplan without affecting the total duration of project so that the activities are implemented in best possible manner. The finalised work plan will be submitted once again post inception workshop.

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## ***12. Next actions***

Some of key next actions under the project will be:

**Review of international programmes:** This report provides a brief overview of some of the international programmes relevant for the three selected appliances. The details covered under these programmes is an initial level assessment and will be further strengthened **based on the inputs from stakeholders' discussion in Maldives**. The team will continue the analysis of international programmes in more detail to identify some options /approaches for formulating S&L for the respective appliances in the Maldives.

**Inception workshop:** It is proposed to conduct the inception workshop on 7 February 2018 in Maldives. The workshop will provide an opportunity to the team to interact with local stakeholders and seek necessary information for development of programme.

**Data collection:** This is the most important component of the entire process. Collection of requisite information from the relevant stakeholders will be very crucial for successful implementation of the programme.

- Collection of data from importers for 3 appliances as per the questionnaire
- Collection of information about institutional and regulatory capacity from MEA and MEE
- Collection of information from customs about the existing provisions for monitoring the entry of products in Maldives boarder and the information about key aspects to be covered in the draft regulation for stopping import of products that do not meet the minimum requirements
- Discussion with stakeholders on possible measures for the MV&E



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## 13. Bibliography

1. “Maldives”, 13 February 2018 <<https://atlas.media.mit.edu/en/profile/country/mdv/>>
2. ADB, **Maldives’ Energy Sector Assessment, 13 February 2018**
3. “Maldives cuts electricity subsidies”, 14 February 2018  
<<http://maldivesindependent.com/politics/maldives-cuts-electricity-subsidies-121777>>
4. National Energy Agency, 20 February 2018 <<http://www.nea.gov.sg>>
5. CLASP S&L database, 4 August 2017
6. Technical Analysis of Market to Develop Energy Efficiency Labels in Maldives, 2016
7. UAE.S 5010-2:2012 Labelling – Energy Efficiency for Electrical Appliances Part 2: Washing Machines and Dryers
8. “WELS products”, 20 February 2018 <<https://www.pub.gov.sg/wels/welsproducts>>
9. TGL-07-R3-14, “Green Label Product - Room Air Conditioner”
10. Tgl-3-R2-02, “Refrigerator”
11. **BigEE**, “Energy efficient washing machines – China”, 2014
12. “Code of Practice on Energy Labelling of Products”, Hong Kong, 2014
13. TGL-13-R1-07, “Washing Machines”

# Appendix A. - Questionnaires prepared for engagement with retailers

## A.1. Air conditioners

S. No.	Query	Response		
1	Segmentation of air conditioner import /sales in FY 2017 by type  <i>Kindly mention segmentation in terms of percentages</i>	Machine type	Percentage	
		Window type – fixed speed Split type – fixed speed Window type – variable speed Split type - variable speed		
2	Segmentation of window-type air conditioner sales in FY 2017 by capacity  <i>Kindly mention segmentation in terms of percentages</i>	Capacity range	Unit (BTU/h or ref. ton)	Percentage
		Upto 9000 9000 – 12000 12000 – 18000 18000 – 24000 24000+	BTU/h	
2	Segmentation of split-type air conditioner sales in FY 2017 by capacity  <i>Kindly mention segmentation in terms of percentages</i>	Capacity range	Unit (BTU/h or ref. ton)	Percentage
		Upto 9000 9000 – 12000 12000 – 18000 18000 – 24000 24000+	BTU/h	
3	From which countries are window type – fixed speed air conditioners imported (top 3 countries)?  <i>Kindly mention percentages</i>	Country	Percentage share for window type – fixed speed air conditioners	
4	From which countries are split type – fixed speed air conditioners imported (top 3 countries)?  <i>Kindly mention percentages</i>	Country	Percentage share for split type – fixed speed air conditioners	

5	From which countries are window type – variable speed air conditioners imported (top 3 countries)? <i>Kindly mention percentages</i>	Country	Percentage share for window type – variable speed AC
6	From which countries are split type – variable speed air conditioners imported (top 3 countries)? <i>Kindly mention percentages</i>	Country	Percentage share for split type – variable speed air conditioners
7	Are energy efficiency labels present on the air conditioner models sold in the Maldives? <i>If yes, kindly comment on the ratings (star levels) of air conditioners sold</i>		
8	What are the main purchasing criteria for a consumer while purchasing an air conditioner?  <i>Kindly mention ranking</i>	Criteria	Rank
		Price	
		Aesthetics	
		Energy consumption	
		ODP	
		Features	

## A.2. Refrigerator

S. No.	Query	Response		
1	Segmentation of refrigerator import /sales in FY 2017 by type  <i>Kindly mention segmentation in terms of percentages</i>	Machine type	Percentage	
		Absorption type Compression type		
2	Another way of segmentation of refrigerator import /sales in FY 2017 by type  <i>Kindly mention segmentation in terms of percentages</i>	Machine type	Percentage	
		Single door (direct cool)  Double door (frost free) with freezer section on the top  Three door  Side-by-Side (multi door)  Others.		
3	Segmentation of absorption-type refrigerator sales in FY 2017 by capacity (Gross Volume)  <i>Kindly mention segmentation in terms of percentages</i>	Capacity range (Gross volume in Litres)	Percentage	
		Less than 100 100 to 200 ...		
4	Segmentation of compression-type refrigerator sales in FY 2017 by capacity (Gross Volume)  <i>Kindly mention segmentation in terms of percentages</i>	Capacity range (Gross volume in Litres)	Percentage	
		Less than 100 100 to 200 ...		
5	Details of capacity of each type of refrigerator	Type	Gross volume in L	Percentage
		Single door (direct cool)	≤ 100	
			> 100 & ≤ 200	
			> 200 & ≤ 300	
			300 above	
		Double door (frost free) with freezer	≤ 200	
> 200 & ≤ 250				
> 250 & ≤ 300				

		section on the top	> 300 & ≤ 350	
			> 350 & ≤ 400	
			> 400 & ≤ 500	
			> 500	
		Three door		
		Side-by-Side (multi door)		
		Others		
6	From which countries are absorption-type refrigerators imported (top 3 countries)? <i>Kindly mention percentages</i>	Country	Percentage share for absorption-type refrigerators	
7	From which countries are compression-type refrigerators imported (top 3 countries)? <i>Kindly mention percentages</i>	Country	Percentage share for compression-type refrigerators	
8	Are energy efficiency labels present on the refrigerator models sold in the Maldives? <i>If yes, kindly comment on the ratings (star levels) of refrigerators sold</i>			
9	What are the main purchasing criteria for a consumer while purchasing a refrigerator?  <i>Kindly mention ranking</i>	Criteria	Rank	
		Price		
		Aesthetics		
		Energy consumption		
		ODP		
		Features		

## A.3. Washing machine

S. No.	Query	Response		
1	Segmentation of washing machine import /sales in FY 2017 by type  <i>Kindly mention segmentation in terms of percentages</i>	Machine type	Percentage	
		Semi-automatic Top-loader Front-loader Washer-dryers		
2	Segmentation of washing machine sales in FY 2017 by capacity  <i>Kindly mention segmentation in terms of percentages</i>	Capacity range	Unit (kg or L)	Percentage
		≤ 5	kg	
		6 – 8 ...	kg	
3	From which countries are semi-automatic machines imported (top 3 countries)?  <i>Kindly mention percentages</i>	Country	Percentage share for semi-automatic machines	
4	From which countries are top-loaders imported (top 3 countries)?  <i>Kindly mention percentages</i>	Country	Percentage share for top-loaders	
5	From which countries are front loaders imported (top 3 countries)?  <i>Kindly mention percentages</i>	Country	Percentage share for front loaders	
6	From which countries are washer dryers imported (top 3 countries)?  <i>Kindly mention percentages</i>	Country	Percentage share for washer dryers	
7	Are energy efficiency labels present on the washing machine models sold in the Maldives?  <i>If yes, kindly comment on the ratings (star levels) of washing machines sold</i>			
8		Criteria	Rank	

<p>What are the main purchasing criteria for a consumer while purchasing a washing machine?</p> <p><i>Kindly mention ranking</i></p>	Price	
	Aesthetics	
	Energy consumption	
	Water consumption	
	Features	

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**Ministry of Environment**

# Development and Implementation of Standards and Labelling Programme in the Maldives

*Energy Efficiency Labelling Programme – Task 2*

Strengthening Low Carbon  
Energy Island Strategies (LCEI) Project



# List of abbreviations

AC	Annual Energy Consumption
°C	degrees Celsius
AEC	Annual Energy Consumption
APF	Annual Performance Factor
AQSIQ	General Administration of Quality Supervision, Inspection and Quarantine
AS/NZS	Standards Australia/ Standards New Zealand
ASEAN	Association of South East Asian Nations
AV	Adjusted Volume
BEE	Bureau of Energy Efficiency, India
BIS	Bureau of Indian Standards
BTU	British thermal unit
C, M, Y, K	Cyan, Magenta, Yellow, Black
CAGR	Compound annual growth rate
CEC	Comparative Energy Consumption
CFC	Chlorofluorocarbon
CLASP	Collaborative Labelling and Appliance Standards Program
CNCA	Certification and Accreditation Administration of the People's Republic of China
CNIS	China National Institute of Standardization
COP	Coefficient of Performance
COR	Certificate of Registration
CSEC	Cooling Seasonal Energy Consumption
CSPF	Cooling Seasonal Performance Factor
CSTL	Cooling Seasonal Total Load
dB	Decibel
DCR	Direct Cool Refrigerators
DEDE	Department of Alternative Energy Development and Efficiency
DSM	Demand Side management
ECI	Energy Consumption Index
ECP	Energy Conservation Promotion
EE	Energy Efficiency

EEF	Energy Efficiency Factor
EER	Energy Efficiency Ratio
EGAT	Electricity Generating Authority of Thailand
ELS	Energy Labelling Scheme
EPC	Energy Performance Certificate
ESCO	Energy Service Company
ESMA	Emirates Authority for Standardization and Metrology
EU	European Union
FFR	Frost Free Refrigerator
FGD	Focus Group Discussions
FY	Financial year
GHG	Greenhouse Gas
GWP	Global Warming Potential
HCFC	Hydrochlorofluorocarbon
hr	Hour
HSPF	Heating Seasonal Performance factor
Hz	Hertz
IAME	Independent Authority for Monitoring and Enforcement
IEC	International Electrotechnical Commission
INR	Indian Rupee
IS	Indian Standard
ISEER	Indian Seasonal Energy Efficiency Ratio
ISO	International Organization for Standardization
JICA	Japan International Cooperation Agency
JIS	Japanese Industrial Standards
kCal	kilocalorie
kg	Kilogram
kW	kilowatt
kWh	kilowatt hour
L	litre
LCEI	Strengthening Low Carbon Energy Island Strategies
Ltd.	Limited

M&V	Monitoring & Verification
M,V&E	Monitoring, Verification & Enforcement
MD	Managing Director
MEA	Maldives Energy Authority
MED	Ministry of Economic Development
MEE	Ministry of Environment and Energy
MEELS	Mandatory Energy Efficiency Labelling Scheme, Hong Kong
MEES	Minimum Energy Efficiency Standards
MELS	Mandatory Energy labelling Scheme
MEPS	Minimum Energy Performance Standard
MEPSL	Minimum Energy Performance Standards and Labelling
MHTE	Ministry of Housing, Transport and Energy
MRA	Mutual Recognition Arrangement
MS	Malaysian Standard
MVR	Maldives Rufiya
N.A.	Not Applicable
NDRC	National Development and Reform Commission
NEA	National Environment Agency
ODP	Ozone Depletion Potential
PAEC	Projected Annual Energy Consumption
PICT	Pacific Island Countries and Territories
PMU	Project Management Unit
Pvt.	Private
REEEP	Renewable Energy & Energy Efficiency Partnership
RKC	Revised Kyoto Convention
RMC	Remaining Moisture Content
S&L	Standards and Labelling
SAARC	South Asian Association for Regional Cooperation
SAFTA	South Asian Free Trade Area
SDA	State Designated Agencies
SEC	State Electricity Company, Maldives
SEER	Seasonal Energy Efficiency Ratio
SIRIM	Standard and Industrial Research Institute of Malaysia

SOP	Standard Operating Procedures
SRB	Star Rating Band
STO	State Trading Organization
TEI	Thailand Environment Institute
TIS	Thai International Standard
TTD	Through the Door
TV	Television
UAE	United Arab Emirates
US	United States
USD	U.S. Dollar
V	Volts
WCO	World Customs Organization
WELS	Water Efficiency Labelling Scheme
WF	Water Factor
Wh	Watt Hour
YoY	Year over Year

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# 1. Introduction

## 1.1. Energy scenario in the Maldives

Energy consumption in the Maldives is increasing steadily on the backdrop of rising demand for electricity and transport sectors – the two main drivers for energy in the country. The power generation is almost entirely dependent on diesel-based fuel generators, as country-wide electrical grid systems are not feasible. The Maldives has no known indigenous petroleum, gas, or coal resources; and hydropower is not feasible because of the topography. Consequently, with total dependence on imports for power generation, petroleum-based fuels are a major import in the Maldives. In fact, the Maldives spent approximately \$239 million on oil imports in 2016<sup>1</sup>, of which fuel imports for electricity generation are the largest contributor.

The government indicates that dependency on imported fuels has worsened since the early 1990s. During the last five years the imports of Maldives have increased at an annualized rate of 12.4%, from \$1.52 billion in 2011 to \$2.12 billion in 2016. **The most recent imports are led by Refined Petroleum which represent 11.3% of the total imports of Maldives.**<sup>2</sup> Firewood and petroleum are the only commercial fuels, and firewood and liquefied petroleum gas are used for cooking in households. **As such the Maldives is extremely vulnerable to oil price variations in Asia and the Pacific.**

*STELCO, the State Electricity Company and Fenaka, a utility company to provide electricity, water, and sewerage services on the outer islands, together consumed nearly 120 million litres of diesel to produce electricity in the same year.*

The high dependence on diesel generators for electricity production has contributed to driving the retail tariffs of electricity extremely high in the country at about \$0.40 per kilowatt-hour<sup>3</sup>, several times more than other countries in the region. As a result, until 2016, the government granted subsidies for fuel surcharge and usage cover a portion of the cost of electricity for certain consumer categories, such as domestic consumers on the outer islands. However, these subsidies were subsequently withdrawn<sup>4</sup> to a certain degree.

## 1.2. Need for standards & labelling programme

Given that **electricity demand is expected to double by 2020 compared to the 2012** on the backdrop of an increase in usage by tourism sector, the government of Maldives is considering promoting alternative energy sources as a diversification strategy and to **support energy efficiency initiatives.**

**Consequently, the key features of the government's national energy policy include providing all citizens with access to affordable and reliable electricity services, increasing energy security, promoting energy efficiency and conservation, and moving toward the target of renewable energy based electricity supply.**

While the dispersed population in the outer islands invariably increases the costs of providing electrical services, and economies of scale are insufficient, the utilities will need to address the high variability in fuel conversion efficiency and distribution loss levels among the outer islands through investments in newer and more efficient mini-grids and control systems.

In the demand side, an energy efficiency standards & labelling programme for electrical appliances is a key policy option in the government's arsenal to promote purchase and use of efficient appliances. In fact, the LCEI PMU,

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<sup>1</sup> Source: <https://atlas.media.mit.edu/en/profile/country/mdv/>, retrieved on 13 February 2018

<sup>2</sup> Source: <https://atlas.media.mit.edu/en/profile/country/mdv/>, retrieved on 13 February 2018

<sup>3</sup> Source: ADB – Maldives' Energy Sector Assessment, retrieved on 13 February 2018

<sup>4</sup> Source: <http://maldivesindependent.com/politics/maldives-cuts-electricity-subsidies-121777>, retrieved on 14 February 2018

identified significant potential for supply- and demand-side energy efficiency through measures such as development of equipment codes and standards, measures for public buildings, and generator upgrades.

### ***1.3. Challenges in implementation of S&L program***

Some of the key challenges that exists towards implementation of the labelling programme for the appliances in Maldives based on the experience of project team are summarized below (these challenges will be further evaluated during the course of project):

- Lack of sufficient information on the best practices that are being followed internationally under the gambit of energy efficiency especially in appliance sector which is a key input for developing the labelling programme in Maldives as most of the local consumption is through import from other countries.
- Alignment/harmonization of global S&L programmes with respect to technical details of appliances will be a challenge
- For taking forward EE labelling programme, it is pertinent to reach out to consumers and understand the factors influencing their choice of selecting products. Keeping in view the diverse nature of local market needs, the energy efficiency legislation sets the mechanism to map these factors. Thus the labelling programme regulation should provide institutional and delivery mechanism for energy efficiency measures in Maldives and the much-needed coordination between the various entities. The proposed regulations needs to be revised to cover these aspects.
- Non-availability of testing standards and procedures for establishing energy performance for appliances.
- Country needs a thoroughly developed framework for monitoring and verification of policy measures especially for the labelling programme so that integrity is ensured.
- Absence of ESCO project (s) business models, market transformation strategies for uptake of energy efficient appliances, retrofit programme methodology etc.

### ***1.4. Scope of work***

In view of the above challenges, the present assignment intends to address the issues by providing support to MEE, MEA and key stakeholders through policy analysis, capacity building and implementation support for energy efficiency labelling programme. The assignment also intends to **support the government's initiative on** development of an implementation plan to fast-track the implementation of appliance labelling measures and create a sustainable pool of human resources in the country. The scope of work for the assignment is described below:

- Inception meeting with stakeholders and finalizing the detailed methodology and work plan
- Develop recommendation for an EE labelling programme
- Recommend EE labelling program implementation procedure
- Framework to monitor implementation of the EE labelling programme
- Impact assessment of enforcement of EE labelling programme
- Implementation plan for rolling out EE labelling programme
- Stakeholder sessions during development of EE labelling programme & dissemination workshop

## ***2. Project initiation – contract signing ceremony***

### ***2.1. Award of contract and signing ceremony***



*Figure 1: Contract signing ceremony held on 09 January 2018*

A ceremony for signing the contract for “development of energy efficiency labelling programme in Maldives” was held on 09 January 2018 in the Auditorium, Ministry of Environment and Energy, Maldives. The project team from PwC India undertook their first mission to Maldives for the ceremony and initiating the project activities.

Honourable Thoriq Ibrahim, Minister of Environment and Energy signed the contract on behalf of the Ministry and Mr. Amit Kumar, Partner, signed the contract on behalf of PricewaterhouseCoopers Private Limited. Honourable Abdullahi Majeed, Minister of State, MEE and Mr. Rajeev Ralhan, Director, PwC, witnessed and also signed the contract on behalf of their respective organizations.

Honourable Minister conveyed the importance of this project from the viewpoint of energy efficiency. He shared that the government is focussing on initiatives and practices to address climate change issues and will initiate policy measures to facilitate implementation of such practices. It was shared that the objective of the assignment is to initiate the implementation of an energy efficiency labelling (EE Labelling) programme for selected



appliances in the Maldives. Under the consultancy, PricewaterhouseCoopers will develop detailed methodology to issue energy efficiency labels for selected appliances along with necessary forms, documentation, and to develop monitoring methodology for the Labelling programme.

Mr. Amit Kumar conveyed his gratitude to the Ministry for organising the ceremony. He welcomed all stakeholders present during the ceremony and shared that this is an important assignment for Maldives as the development of standards and labelling programme under this project will not only facilitate uptake of energy efficient appliances in the Maldives but will also facilitate the country in meeting climate change goals. He shared a few insights from his experience highlighting the successful implementation of S&L programmes in various countries globally. He also shared his experience of working with MEE in past for one of the projects related with clean energy and highlighted that the team will once again closely work with local authorities for development of S&L programme in a manner in which the programme gets push from the market on its own.

The signing ceremony ended with a vote of thanks to the dignitaries and was followed by tea and snacks.

## ***2.2. Introductory discussions***

Post signing ceremony the team from PwC conducted a few rounds of discussions with officials of LCEI project and MEA over the next two days. The progress that have been made so far in Maldives through studies conducted in past was discussed. Also, the overall approach for undertaking specific tasks under the project was presented in brief to understand the expectations of MEA.

Key members present in the discussions are:

- Mr. Mohamed Inaz, LCEI Project Manager, MEE
- Ms. Fathimath Raufa Moosa, LCEI Project M&E Officer, MEE
- Mr. Muawiyath Shareef, Director – Technical Regulations, MEA
- Mr. Akram Waheed, Engineer – Technical Inspections, MEA
- Ms. Shara Mauroof Ahmed, S&L Officer, MEA
- Mr. Rajeev Ralhan, Director, PwC
- Mr. Mohit Verma, Manager, PwC

Following is the brief summary of key discussions:

**Highlights on the work done so far:** To begin with the project manager from LCEI project, Mr. Inaz shared some key insights on the work done in past for preparation of S&L program. He briefly shared the outcomes of studies such as:

- Development of manual for official recommended electric appliances approval procedure by JICA in 2010
- Development of consultation paper and draft energy labelling regulation by Mercados in 2012
- Research on Consumer Behaviour and Preferences Regarding Energy Efficiency in Households by Riyan Pvt. Ltd. in 2017, under the aegis of the LCEI project
- Technical Analysis of Market to Develop Energy Efficiency Labels in Maldives in 2017, under the aegis of the LCEI project

Mr. Inaz and colleagues shared that the report from JICA is useful to understand the thought process behind the labelling programme and although the findings of the report would need to be reassessed based on the current

market dynamics of appliances and international best practices for energy efficiency labelling programme. It was shared that the market analysis and consumer research done in recent past will be very useful for the intended outcomes under the proposed study. He also shared that the information covered under the market analysis report is authentic as it has been obtained from customs. The team from PwC enquired about the technical details of the appliances for which market analysis was done. Mr. Inaz shared that though their partners tried to obtain **the technical details of appliances but that information wasn't available with customs and the information from importers was very limited.**

The team from PwC thanked Mr. Inaz and his colleagues for taking them through on the work done in past. Mr. Rajeev requested the copy of reports and documents for a detailed review so that the team can take cues from the earlier studies. Mr. Inaz accepted and shared the copies with the team for reference.

**Discussion with MEA:** The team from PwC requested a brief discussion with MEA officials to understand their existing setup and planning for implementation of standards and labelling programme. The officials from MEA shared that they have recently recruited one local consultant in the capacity of S&L officer. The officer will closely **work with LCEI project personnel and PwC's project team for development of S&L programme in the Maldives.** The project team requested the details from MEA such as: legal mandate for development of energy standards and labelling scheme; legal provision of taking actions against non-compliance of standards; institutional capacity as on date for the implementation of labelling programme; their expectation from the project, etc. The officials from MEA informed that they will share the details of legal mandate with project team. It was shared that MEA is working on introduction of a new electricity act to regulate the aspects under energy supply and installation and in some section there will be convergence with the requirements under energy efficiency labelling programme. It was shared that as of now mechanism or rule for penalising the defaulters of regulations /standards made by MEA is not available however with the revisions in electricity act such requirements can be addressed. Regarding the **institutional capacity, it was shared that MEA's existing team structure is lean and they will be expanding their existing structure in near future with the development of S&L programme.** The MEA officials requested the project team to share a roadmap of activities that are important from the viewpoint of implementation of S&L programme. The project team thanked the members of MEA for joining the discussions.

**Discussion towards conducting inception workshop:** There was a brief discussion on the schedule for project inception meeting cum workshop wherein a few stakeholders could also attend and facilitate in data collection. It was jointly discussed and proposed that the half-day workshop should be conducted either on 6<sup>th</sup> or 7<sup>th</sup> of February 2018. The local stakeholders who will attend the workshop was also decided. The details are mentioned in the workshop agenda attached in subsequent chapters of this report.



## 3. Project inception workshop and stakeholders' discussions

### 3.1. Details of inception workshop



Figure 2: Project inception workshop held on 07 February 2018

A workshop for inception of the project “development of energy efficiency labelling programme in Maldives” was held on 07 February 2018 in the Auditorium, Ministry of Environment and Energy, Maldives. The project team from PwC India undertook their second mission to Maldives for the workshop and consultative discussions with relevant stakeholders.

The list of participants of inception workshop is shared below:

Table 1: List of participants in inception workshop

Sr. no.	Name of participants	Designation	Organization
1.	Ajwad Mustafa	Permanent Secretary	Ministry of Environment & Energy
2.	Ali Shareef	Director	Ministry of Environment & Energy
3.	Muawiyath Shareef	Director	Maldives Energy Authority
4.	Miruz Mohamed	Director	Ministry of Environment & Energy
5.	Ahmed Migdhad	Director	Ministry of Economic Development
6.	Zammath Khaleel	Assistant Director	Ministry of Environment & Energy
7.	Mohamed Inaz	Project Manager	Ministry of Environment & Energy
8.	Fathimath Raufa Moosa	M & E Officer	Ministry of Environment & Energy
9.	Shara Mauroof Ahmed	Standards & Labelling Officer	Maldives Energy Authority
10.	Aishath Zuha	Programme Officer	Ministry of Environment & Energy
11.	Rajeev Ralhan	Director	PwCPL, India
12.	Prasanta Kumar Misra	Associate Director	PwC, Maldives
13.	Mohit Verma	Manager	PwCPL, India
14.	Adam Shafeeg	Superintendent	Customs Service
15.	Ahmed Iflah	Assistant Manager	State Trading Organization

16.	Ziran Ali	Support Engineer	State Trading Organization
17.	Nashiya Saeed	Senior Consultant	CDE Pvt. Ltd.
18.	Simad Saeed	Managing Director	CDE Pvt. Ltd.
19.	Mauman Abdul Rasheed	Project Officer	Ministry of Environment & Energy
20.	Aminath Zahira	Statistical Officer	Maldives Energy Authority

The workshop began with a brief description provided by Mr. Ajwad Mustafa, Permanent Secretary, MEE, and Mr. Rajeev Ralhan, Director, PwC, on the need of developing a standards and labelling programme in the Maldives. It was shared that the market for electrical appliances in the country is completely driven by imports from other countries. Since, there are no product standards developed in Maldives at present, it is necessary for the country to create energy standards which will facilitate in prohibiting the import of inferior quality products (in terms of energy) from outside countries. Mr. Ajwad briefed the members present about the project entrusted to PwC for supporting the MEA and MEE in development of the programme. All participants present in the workshop were requested to actively share their views during the development process as the success and failure of the S&L programme hugely depends upon the stakeholder engagement.

The key highlights of the various discussions during the workshop are shared below.

Mr. Simad Saeed, MD, CDE Pvt. Ltd., presented an overview of the market analysis work carried out by their team for electrical appliances in the Maldives. Through his presentation Mr. Simad touched upon areas such as objective of the market analysis work, their methodology, key results and findings. He shared that the entire methodology and findings presented in their report is solely based upon the information they have gathered either from the customs services and/or technical information available on the product labels such as energy label available on the appliances. He presented appreciation and thanks to the customs services for their active support in market analysis work. Some of the key points discussed during his presentation are:



- Mr. Simad covered the key countries from which the appliances (specifically air conditioners, refrigerators and washing machines) are being shipped to Maldives as well as the country of manufacturing. He shared that as of now the percentage of import of appliances manufactured in India and Thailand is not significant but this is expected to increase in years to come. He further shared that some of the key factors which govern the sale of appliances in the Maldives are price, brand, after sale services, etc. also mentioned after sale services are not available in the islands so this is taken advantage of by brands.
- Regarding the growing market size he shared that there are various developmental projects undergoing in the country. The Hulhumale Island is being completely developed with various residential and commercial projects going-on there. The appliances such as air conditioner and refrigerator will be in high demand owing to the requirements from all these projects. Mr. Rajeev shared that this is an important information and proposed that Ministry of Housing shall be considered as one of the stakeholders in future discussions for the S&L programme.
- Mr. Simad also briefly covered aspects related with air conditioner, refrigerator and washing machine specifically. He shared that air conditioner of capacity 9000 Btu/hr to 18000 Btu/hr covers majority of the market in the Maldives. The refrigerators of bigger sizes i.e. beyond 400 litres capacity are slowly expanding in the market and also the mini-refrigerators (used a mini-bar in hotels) are in higher numbers. For washing machine, Mr. Simad emphasised on the fact that this appliance is used differently

in the Maldives than in other countries. He shared that since efficient water usage is a very important component in island countries therefore for washing machines, people consider product models as their choice of purchase which uses less water for washing the cloths.

- Mr. Rajeev enquired about the technical details of appliances such as energy consumption range covered in the market analysis report and expressed that some of the values mentioned seems to be inappropriate. Mr. Simad acknowledged the question and shared that during their work they also observed some of these details and then they rechecked the entire analysis. He shared that the information covered is based on the energy labels affixed over the appliances.

The above discussion was followed by a detail presentation from PwC team. Mr. Rajeev Ralhan and Mr. Mohit Verma presented the overview of the project for developing the standards and labelling programme for air conditioner, refrigerator and washing machine in the Maldives. Some of the key points discussed during the remaining part of workshop are:

- Mr. Rajeev covered in detail the objective of the project and each of the key tasks which will be undertaken by their team during the course of development of S&L programme. He shared that one for foremost tasks for the programme is market assessment. It was shared that the team will be considering the inputs received from market analysis study conducted earlier for market assessment however some of the information such as type wise categorization of appliances in the market, label details etc. needs to be captured in detail. For this purpose, the PwC team has prepared a few questionnaires which have been circulated by MEA to key importers. Mr. Rajeev requested the importer to provide relevant information and fill the questionnaires.



- Mr. Rajeev shared that for the development of S&L programme in Maldives their team will undertake review of programme in other countries and specifically from where the appliances are being imported in Maldives as well as the countries of manufacturing. The stakeholders present in the workshop had the consensus over the approach presented by PwC team. It was suggested to consider the review of programme in countries such as China, Singapore, Thailand, India, and Malaysia for the three appliances shortlisted for S&L.
- Mr. Rajeev highlighted the need of linking energy label in the Maldives with GWP (Global Warming Potential) through the appliance S&L. He shared that this will facilitate in linking the programme with climate change goals. Ms. Miruza acknowledged the proposed approach and shared that the ozone unit have proposed the requirements for refrigerants to be used in the appliances which are being imported and the existing regulations can be linked with the upcoming S&L programme. Ms. Miruza also emphasised on the need to capture the scenario of import of second-hand or cheap quality products in the country.
- Mr. Rajeev explained about the need of developing standards in the country. He explained the need of product standards vis-à-vis energy standards. He shared that while the energy standards for appliance will address the energy efficiency performance requirements of the appliances however the basic necessity of the energy standard is the product standard which addresses all safety aspects. The product standard defines the tests to be performed and the methodology to be used for testing of appliance. He shared that usually the energy standards cum regulation refer the already established product standard for the tests and protocols to be followed for assessment of energy performance. He enquired about the product standards and its respective implementing body in the Maldives. Mr. Migdhad shared that

Ministry of Economic Development is developing a few national standards in the country. Ms. Miruza **shared that as of now there isn't any authority with clear mandate for developing national product standards** in the Maldives because the standards which will be developed by MEA will be covering the energy aspects. Ms. Miruza requested MED to discuss and then define a mandate for developing the national standards so that its respective requirements could be addressed by the concerned authority. Mr. Migdhad acknowledged and shared that MED is in the process of defining the mandate for developing national standards. Mr. Migdhad further shared that MED is developing a trademark which will be circulated soon, this will help to address any counterfeit issues. This trademark will be made mandatory for certain appliances depending upon the safety requirements. Once the trademark is developed then the customs will include this in their process of providing import clearance for the shipped items. Mr. Rajeev thanked the Mr. Migdhad and Ms. Miruza for their inputs and requested the stakeholders to work upon developing national standards in the country in near future. Mr. Rajeev shared that since there are no product standards developed in the Maldives yet hence the internationally accepted standards could be referred for energy efficiency programmes. The standards and labelling programme can be based upon the international test standards which are mostly referred in the countries considered for review of S&L programme such as the standards developed by International **Electrotechnical Commission (IEC)**. **The stakeholders' shared their agreement with the approach suggested for the S&L programme.**

- Mr. Rajeev then discussed the probable approaches for implementation of the S&L programme. He shared that one of the requirements is to define whether the affixing of authorised energy label shall be done from the place where the appliance are exported i.e. by the exporters or manufacturers of appliances or else by the importer of appliances in the Maldives after the shipment is arrived in Maldives port. There was a unanimous agreement between the stakeholders that the labels should be affixed by the exporters and/or manufacturers. The importers should not have the authority to affix or change the label upon the **receipt of goods in Maldives port as this might jeopardise the integrity of customs' inspection process.** Mr. Shafeeg from customs shared that such a process already exists for cigarettes wherein the exporters provide the labelling as per the requirements. Also, for some food items this is followed.

- Mr. Mohit presented the step-by-step process for developing the standards and labelling programme. He shared the various phases of S&L programme, the key stakeholders of the programme, proposed roles and responsibilities of the key stakeholders, etc. He also presented the key difference in developing and implementing the S&L programme between an island country vis-à-vis a continent and bigger country. He shared that the entire purpose of explaining this to the stakeholder



is to make them aware about every aspect of S&L programme so that it is easier for them to understand the expectations and deliberate in the interest of developing a realistic programme in the country. Mr. Mohit presented a case study for S&L programme developed in Fiji which is also an island country. He shared that this case study will be useful for Maldives as the market in Fiji is also dependent on imported appliances. Mr. Ajwad enquired that whether the climate in Fiji is similar to Maldives as to understand **the applicability of Fiji's case with Maldives.** **Mr. Mohit shared that climate conditions is an important aspect** and the team will review the climate conditions during the development process. It was also shared that appliances that are used all over the world and are being exported /imported in various countries

are mostly of technologies which can work in multiple climate zones. The example from Fiji or other countries would be more applicable from the implementation point of view as the overall process will be much simpler in Maldives. It was discussed that climate of Singapore is much similar to Maldives and hence the programmes in Singapore will be reviewed in detail.

- Mr. Mohit briefly presented the overview of some of the international S&L programmes. He shared that countries for the review of international programmes have been selected based on the results of market analysis study and internal discussion with MEA and MEE which has been also discussed during the starting discussion of this workshop. He shared that the review of international programme will be useful for identifying the most relevant programme for Maldives.
- There was discussion regarding loss of refrigerants in the environment during the product running and servicing. Ms. Miruza shared that ozone unit is working on developing a certification scheme for technicians in air conditioner and refrigerator sector. The certification process is a mechanism to practically guide them about the key needs during service, dumping etc. from the environmental standards viewpoint. The stakeholders agreed that there is a need for defining a guideline for waste management of products in the country.
- The need for training, capacity building and awareness was discussed in detail. Mr. Rajeev shared in-brief the key areas wherein the stakeholders needs to be well informed to be able to implement the programme more effectively. The stakeholders shared that it would be important to conduct a few stakeholder-wise capacity building sessions after the development of S&L programme.
- **Regarding the stakeholders' participation** it was proposed that MEA can formulate a working group of key stakeholders which can meet more frequently to deliberate on areas under the S&L programme and proceed with consensus based approach.
- The next actions for the programme was discussed. Mr. Rajeev and Mr. Mohit requested importer to share the data in the form of questionnaires filled with responses.



The meeting ended with a vote of thanks to all stakeholders present in the inception workshop. The meeting was followed by a networking lunch hosted by MEE.

## 3.2. Details of stakeholders' discussions held

### 3.2.1. Discussion with CDE consulting Pvt. Ltd.

Table 2: List of participants during discussion with CDE Consulting Pvt. Ltd.

Participants	Date and time	Medium
Mr. Simad Saeed, Managing Director, CDE Consulting Pvt. Ltd.	08 February 2018,	In-person
Ms. Nashiya Saeed, Senior Consultant, CDE Consulting Pvt. Ltd.	0815 hrs	discussion
Ms. Fathimath Raufa Moosa, LCEI Project M&E Officer, MEE		
Ms. Shara Mauroof Ahmed, S&L Officer, MEA		
Mr. Mohit Verma, Manager, PwC		

The meeting began with a brief description provided by the project team on key areas where the inputs from CDE will be helpful for the standards and labelling project. It was shared that the market analysis report prepared by CDE captures the broader aspect of market size and trend of the respective appliances which is useful to understand the market pattern. However, the details related with aspects such as a product classification, consumer sentiments and in-general purchase pattern will be required for the program. The team requested CDE to share their learning from the market analysis work.

Some of the key points shared by CDE and discussed during the meeting are as follows:

- The market for the appliances shortlisted to be covered under the standards and labelling as of now is mostly governed by established brands. However, in the recent past some of the unfamiliar and local brands have also entered the market on account for their much lower prices than the established products. These are mostly the assembled products and the performance may be doubtful. The importer **which are importing these products needs to understand the expectations from MEA's upcoming labelling requirements and undertake necessary actions for qualification of products.**
- The local market in the Maldives is shifting from the sole distributorship model to the multi-brand outlets likewise in the other parts of world. Thus, the competition is rising in the country.
- The free trade agreement has been signed between China and Maldives. This is expected to realise in a few months now.
- From the point of view of S&L implementation it would be better if the ministry and government could formulate an independent agency with specific powers and authority to be able to take fast decisions on energy efficiency. This shall facilitate faster adoption of energy efficient technologies in the country and can be a single point of contact for all matters related with labelling.

The meeting concluded with a vote of thanks to the officials from CDE for their time and inputs for the program.

### 3.2.2. Discussion with Maldives Customs Services

Table 3: List of participants during discussion with Maldives Customs Services

Participants	Date and time	Medium
Mr. Adam Shafeeg, Superintendent. Maldives Customs Services	08 February 2018,	In-person
Ms. Minna Rasheed, Chief Customs Officer, Maldives Customs Services	0930 hrs	discussion
Ms. Fathimath Raufa Moosa, LCEI Project M&E Officer, MEE		
Ms. Shara Mauroof Ahmed, S&L Officer, MEA		
Mr. Rajeev Ralhan, Director, PwC		
Mr. Mohit Verma, Manager, PwC		

The meeting began with a brief description provided by the project team on key aspects where customs play an important role for implementation of S&L program.

Some of the key points discussed during the meeting are as follows:

- The project team requested the representatives from customs service for providing a brief description on **process and procedures of operations in Maldives customs' services. It was shared that operations are at par with international Revised Kyoto Convention (RKC) and World Customs Organization (WCO) and thus has been harmonized with international customs procedures.** The online portal of customs service provides the necessary details for an importer to import the products as per provisions under the law. The importer needs to complete registration process, obtain the license & permits, provide the declarations for items to be imported and complete the formalities as per the forms provided by customs. The Ministry of Economic Development (MED) is the governing body for law on import-export. **The tariff's /import duty for various items has been maintained as per the regulations from MED. At present the import duty on residential air conditioner and washing machine is 20%. For refrigerators there is no duty at the moment.**
- **The project then enquired about the good's verification procedure of customs. It was shared that the import items are generally classified as 'prohibited items', 'controlled items' and others. The customs conduct detailed verification for the controlled items and prohibit those items which are not allowed in Maldives.** The usual verification does not involve checking of each and every items however a random inspection is conducted. In case of any non-compliance of import specific laws the consignment gets on hold. A notice period is given to the importer for re-export and/or actions are taken as per the provisions under the regulation.
- The project team shared a brief overview of the requirements under proposed standards and labelling i.e. once the MEA formulates a regulation for energy labelling (and it becomes mandatory) then the consignment of products under labelling would be required to undergo the inspection process. The customs is expected to inspect whether the products are carrying an energy label as per the provisions or not. The team requested the representatives from customs to share their opinion on this. Some of the key thoughts shared are:
  - ✓ In order to cover some of the appliances under detailed inspection these appliances could be **brought-up under the list of 'controlled items' as per the import regulation. This will provide necessary authority for the customs to conduct inspection as per the law.**
  - ✓ The inspection of each and every imported appliance (covered under the energy labelling) can be done by customs service however such a practice is not an ideal system. A random or certain methodology specific inspection is more feasible. Once MEA formulates the regulation on energy labelling of some appliance then customs can prepare a process for inspection of those appliance based on their experience and rules & regulations. This process can then be discussed with MEA in consultation with MED for their inputs and finalizing.
  - ✓ The requirements for refrigerants allowed in Maldives has been already mandated by the ozone unit of MEE and the customs has been addressing these requirements so that any appliance which is carrying refrigerants not permitted **in the Maldives doesn't get the import clearance.** Likewise, the process for energy labelling will be also formulated.
  - ✓ Regarding the opinion on place of affixing energy efficiency label on the products it was shared that from the point of view of Maldives customs service it would be better if the products are imported with label affixed. That is, the affixing of energy efficiency label is done either at the appliance manufacturing end or at the exporting end.
- The team enquired about the general practice of importers in Maldives about the consignment size specific for air conditioner, refrigerator and washing machine. It was shared that usually bigger importers such as STO imports a load of full container however the small importers gets their order in the form or

loose cargo items (common practice is to import in mixed containers, only sometimes in full container loads).

- The project team shared that during the course of development of standards and labelling project the team will be preparing a process flow of complete cycle starting from approval for energy label to importer and till receipt of approved appliance in the local markets. A key component of the entire process is inspection of appliance during import. Hence, in order to get a deeper understanding of complete operations of customs for the relevant areas (inspections) the team requested officials of customs service for allowing them to visit the customs area and witness the existing process. The officials from customs service acknowledged the request and shared that the MEA can write to the competent authority in this regard for seeking the necessary permissions (from Maldives Ports Limited, MPL)
- The project team enquired about the capacity building need for the customs to be able to implement their role under the complete standards and labelling framework. The officials from customs shared that a capacity building cum training would be very useful for their key staff and operations people so that they can align their existing procedure with the expectation of labelling programme. It was shared that a team of approximately 20 personnel from customs would be required to undergo the capacity building session after the formulation of standards and labelling programme.
- Customs also mentioned the SAARC free trade agreement (agreement of south Asian free trade area, SAFTA) excluding items classified as sensitive and PwC enquired whether ACs, refrigerators and air conditioners came under the list of sensitive items to which they replied that they would check and revert back.

The meeting with a vote of thanks to the officials from customs service for their time and inputs for the program.

### **3.2.3. Discussion with Ministry of Economic Development (MED)**

*Table 4: List of participants during discussion with MED*

<b>Participants</b>	<b>Date and time</b>	<b>Medium</b>
Mr. Ahmed Migdhad, Director, MED	08 February 2018, 1030	In-person
Ms. Fathimath Raufa Moosa, LCEI Project M&E Officer, MEE	hrs	discussion
Ms. Shara Mauroof Ahmed, S&L Officer, MEA		
Mr. Rajeev Ralhan, Director, PwC		
Mr. Mohit Verma, Manager, PwC		

Mr. Migdhad on behalf of MED shared that the ministry would be extending complete support to MEA for development and implementation of the intended S&L program. He further shared some of the following insights which will facilitate the development process:

- The MED is in the process of amending the existing consumer protection law. The ministry is progressively working towards formulation of some of the national safety /product /process standards specific for Maldives. It was shared that though there are technical committees existing at present for sectors such as chemical, textile, food, electrical and electronics and construction material, however the interactions within these committees is limited at present. Soon, the ministry will be formulating a **council for standardization “Standards Council” and subsequently additional technical committees will be formed.** Also, the frequency of consultative discussions within the several committees will be increased. Thus, altogether the ministry is working on several areas where there can be convergence of objectives under the proposed S&L program in the Maldives.
- The MED will play a pivotal role in enforcement of upcoming energy standards which will be formulated by MEA for S&L program. It was shared that the import /export regulation /guidelines falls under the



purview of MED and hence it would be important for incorporation of requirements of S&L program under the existing provisions of import /export which will further facilitate implementation of the program.

Mr. Migdhad requested the MEA to share details related with financial requirements such as fees associated with labelling, etc. that is expected to be part of the S&L program. It was discussed that these aspects are under development phase as of now and will be discussed with stakeholders once the programmatic framework is in-place.

The requirements with respect to need of test agency was also discussed. It was shared that the ministry is working for development of test agency for some items (other than appliances) in the country and will be working for other areas also in the near future. Meanwhile, some of the international test laboratories for appliance testing can be identified and shall be referred for the appliance program.

The meeting ended with a vote of thanks to the MED and MEA for their time and inputs for the program.

### **3.2.4. Discussion with State Trading Organization (STO)**

*Table 5: List of participants during discussion with STO*

<b>Participants</b>	<b>Date and time</b>	<b>Medium</b>
Mr. Ahmed Iflah, Assistant Manager, STO	06 February 2018	In-person
Mr. Ziran Ali, Technical Support Engineer, STO	0930 hours	discussion at
Mr. Mohamed Inaz, Project Manager, LCEI Project		MEE office
Ms. Fathimath Raufa Moosa, LCEI Project M&E Officer, MEE		
Ms. Shara Mauroof Ahmed, S&L Officer, MEA		
Mr. Rajeev Ralhan, Director, PwC		
Mr. Mohit Verma, Manager, PwC		

Main Discussion points:

Main objective of the meeting was to convey information regarding the Energy Efficiency Standards and Labelling program and highlight the importance of stakeholder engagement.

- Mr. Mohamed Inaz give an introduction regarding the Energy Efficiency Standards and Labelling program to Mr.Ahmed Iflah and Mr.Ziran Ali.
- He noted that certain information is required from relevant stakeholders for the successful development and implementation of the program and shared the questionnaires prepared by PwC for refrigerators, air conditioners and washing machines.
- Mr. Ahmed Iflah expressed some concerns regarding the communication of classified sales data – Mr.Mohamed Inaz and Ms.Fathimath Raufa Moosa explained that the data is more regarding the types and sub-categories of appliances imported and their respective percentages.
- Mr.Mohit Verma enquired about the classification of appliances and whether they are differentiated accordingly – Mr.Ziran Ali stated that they are segmented and as an example mentioned that air conditioners are differentiated based upon aspects such as wall mounted ACs and ceiling mounted ACs.
- Mr.Mohit Verma also asked whether any labels from importing or manufacturing countries are present on the appliances – Mr.Ziran Ali and Mr.Ahmed Iflah confirmed that some appliances do contain labels whereas others do not.
- Mr.Ziran Ali suggested including additional specifications in the questionnaire such as VRV and VRF air conditioning units.

- Mr.Ziran Ali expressed concerns regarding a possible market shift due to some brands having a label and not others – Mr.Mohamed Inaz and Ms.Fathimath Raufa Moosa clarified this by stating that following the implementation of the program, all appliances will be affixed with the label regardless of brand and that this will be solely based upon its energy efficiency level.
- Mr.Ziran Ali also enquired whether Maldives Energy Authority would verify the information provided by retailers and Mr.Mohamed Inaz mentioned that this would be done by examining test certificates and such.
- Mr.Mohit Verma enquired whether customers ask questions pertaining to existing labels present on appliances for sale and whether this is a purchasing criteria– Mr.Ziran Ali said that they do not and that people usually make purchases based upon brand (e.g. Hitachi), credit schemes and warranty offers provided by STO.
- Mr.Ziran Ali recommended affixing the label at the production stage as it would be impractical to do so post-packaging.
- Ms.Fathimath Raufa Moosa enquired whether the Ministry would be required to approach the manufacturers regarding labelling requirements and Mr.Ziran Ali stated that it would be more productive if STO approached them and that this would be decided by the head office.
- Mr.Mohit Verma asked whether there are any labels present on the appliance packaging and Mr.Ziran Ali replied that there are none and that the only information available on the packaging is regarding handling specifications.

Conclusions:

- Mr.Ziran Ali and Mr.Ahmed Iflah agreed to fill up the questionnaires and send it back by 8<sup>th</sup> February 2018 (Thursday).
- More information will be given during the inception workshop on 7th February 2018.
- Ms. Shara Mauroof Ahmed will e-mail the questionnaires to the STO representatives.

### ***3.2.5. Discussion with State Trading Organization (STO) in their retail store***

*Table 6: List of participants during discussion with STO in their retail store*

<b>Participants</b>	<b>Date and time</b>	<b>Medium</b>
Mr. Ahmed Iflah, Assistant Manager, STO	07 February 2018	In-person
Mr. Abdul Majeed, Senior Manager, STO		discussion at
Ms. Fathimath Raufa Moosa, LCEI Project M&E Officer, MEE		<b>STO's store</b>
Ms. Shara Mauroof Ahmed, S&L Officer, MEA		
Mr. Rajeev Ralhan, Director, PwC		
Mr. Mohit Verma, Manager, PwC		

This was a meeting cum store visit of the State Trading Organization (STO). The project team thanked the officials of STO for allowing the team to conduct the visit on short notice. The visit was primarily to glance through the type of appliances available in the market, labels affixed on the appliances, etc.

Some of the key points shared by STO and discussed during the meeting are as follows:

- The most common size in the market and representative share is:

- ✓ Air conditioner – 9000 to 12000 BTU is the most common range covering 80% share of the sale in the market. Mostly, all ACs sold in the market are of inverter technology type. The models imported by STO usually contain the energy efficiency label of Malaysia.
  - ✓ Refrigerator – The refrigerator with 290 to 400 Litre (gross volume) is the most sold category. The share of direct cool type is about 60% and frost free is 40%. Under frost free the key sub-type is 2 door types. The share of side-by-side refrigerator is negligible.
  - ✓ Washing machine – Most common category is 7.5 kg fully automatic top loading machine. It covers 60% of the market sales. In general, fully automatic top loading is the most selling with about 75% of market share. The rest of market share is of front loading machines. In front loading types the common category is 6.5 kg. The semi-automatic types are less.
- The STO is majorly importing from Singapore.
  - The refrigerants in air conditioner is mostly R410 A at present and now R32 has also started.

Some of the pictures captured for the labels affixed over the appliances are:



## Refrigerator



## 4. An overview of relevant studies conducted in the past

### 4.1. Overview of “manual for official recommended electric appliance approval procedure” – conducted in 2010<sup>5</sup>

The Government of Maldives, through the Ministry of Housing, Transport and Energy (MHTE) and Maldives Energy Authority (MEA) submitted an official request to Japan International Cooperation Agency (JICA) to conduct a “Feasibility Study for Application of Photovoltaic Power on Male and Hulhumale Islands” in 2009.

During the study, it was recognised that DSM /Energy conservation measures should be conducted in parallel to introduction of photovoltaic power. As MHTE and MEA lacked the necessary manpower & technical capacity at the time, JICA was requested to dispatch experts for assistance on the preparatory works of necessary lectures and development of manual for promotion of DSM/Energy conservation measures.

The manual summarises the target electrical appliances, application procedure, evaluation items etc. The recommended application procedure is shown below.

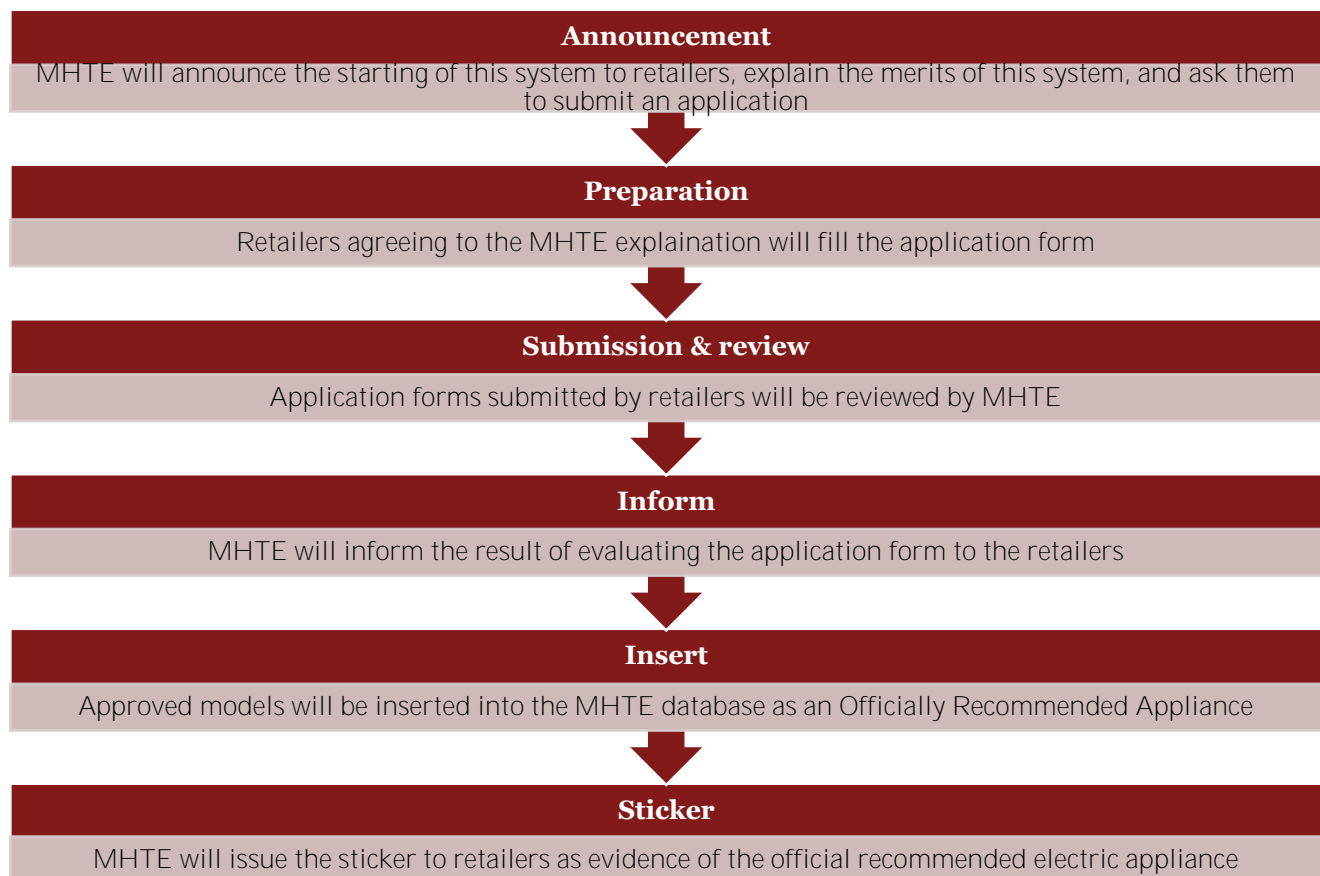
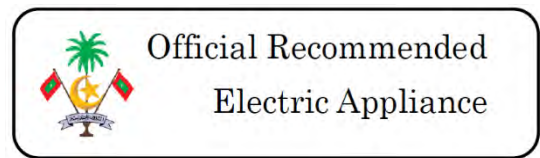


Figure 3: Application procedure proposed in the study "manual for official recommended electric appliance approval procedure"

<sup>5</sup> Information in this section is entirely based on the manual describing the recommended approval procedure for electric appliances shared with the PwC team by MEE, Maldives

*The proposed procedure comprised of six steps, as shown in the above chart. In the announcement phase, MHTE shall announce the starting of this system to retailers, explain the merits of this system, and ask them to submit an application for a particular appliance model. In subsequent stages, importers are required to submit the necessary application and forms, which would then be checked by the MHTE officials.*



*If found in order, the approved models would be awarded the sticker and their names would be posted on the MHTE website as “official recommended appliance”.*

**Air conditioners, fluorescent lamps, and refrigerators were recommended as the target appliances for this programme as per the manual.**

In the application form, retailers would write down the product name, manufacturer name, model number, source country, applicable labelling system, its level etc. in the application form. It was recommended that MHTE verify whether the efficiency level mentioned in the application form is appropriate. They would verify this information on the basis of public information present on the websites of various countries’ labelling programs and submitted information.

The MEPS value recommended for attaining the status of “official recommended appliance” is shown below:

*Table 7: Country wise standard value proposed for the label "official recommended appliance" in the study of 2010*

Country	System name	Standard value in this manual
US	Energy guide label	High rank in top 25%
EU	Energy labelling	A class
Japan	Energy saving labelling program	Green mark
Thailand	Green label	5 class
Singapore	Green ticks	4 ticks
China	Energy consumption efficiency labelling program	1 class
India	Energy star program	5 star

## **4.2. Overview of “draft energy labelling regulation” – developed in 2012**

The draft energy labelling regulation was formed after a consultation held with major stakeholders in the Maldives to improve energy efficiency and reduce impact of climate change.

Three broad approaches to improve energy efficiency were highlighted in the consultation paper.

- Firstly, better and efficient conversion technologies to derive more useful energy from primary energy sources.
- Secondly, there can be many improvements made to the way how the useful energy is transmitted, stored and distributed to end-users.

- Thirdly, the most important approach is at the end-use level, where significant energy savings can be realised by curtailing unnecessary energy use, **improving efficiency of equipment** which provide the required service and adopting better practices.

With the aim to adopt the third approach, Energy efficiency standards and labelling of appliances was proposed as a long term programme which can gradually increase the efficiency of end-use appliances through a market transformation.

**Nature of Program:** It has been discussed that the labelling programme can be implemented at several levels of depth. At one extreme, the programme can rely entirely on energy performance standards set by other countries or agencies. At the other extreme, a fully-fledged system including test facilities and laboratories can be established with a heavy involvement of the stakeholders.

**Import control and fiscal initiatives:** It suggests that the programme could be designed to prohibit the import of severely inefficient appliances, by establishing a Minimum Energy Performance Standard (MEPS). Similarly, efficient appliances can be promoted by levying lower import duty and taxation compared with taxation of ordinary appliances.

**Communication strategy:** Decisions would need to be taken on what genre of information is to be provided on the label. Following information are proposed to be included in the energy label: Rated power (in Watt or other appropriate unit); Energy consumption per month and the likely duration of operation per day which is assumed for estimating monthly energy use by the product; Actual power consumption; Model number; Brand name

**Based on the consultation paper and findings of different studies, the draft regulation for standards and labelling in 2012 was proposed to:**

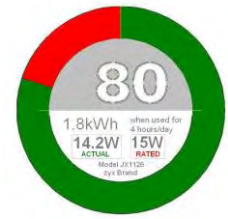
- a) Establish scheme of determining energy performance standards of appliances;
- b) Specify the minimum energy performance standards of appliances;
- c) Establish the rules, procedures and requirements for the energy performance standards and labelling programme including:
  - i. selection of appliances for scheduling
  - ii. registration of a product when an appliance is scheduled
  - iii. entertaining product modifications and changes
  - iv. issuance of energy performance certificates and energy labels

Upon issuance of EPC, the applicant assumes the status of registered supplier of products for which he/she carries a valid EPC issued by MEA and is eligible to affix an energy label on the product as prescribed in relevant schedule of the appliance.

Registered suppliers can request a clearance letter from MEA to facilitate the clearance of products from customs. The request shall be accompanied by the shipping documents, proof of affiliation of the EPC and the batch of products in the current consignment for MEA to prepare the energy labels for the current consignment.

Upon production of the clearance letter of MEA at the customs, the registered supplier shall provide a customs clearance document with details of the shipment to MEA, on which the number of energy labels required for the current consignment.

Label design: The schematic of the proposed label is shown in Figure 4. The toroidal form of the label designates the energy rating, green segment indicating the grading achieved by a particular product and the red segment indicating the room for improvement. The digit on the middle illustrates it numerically.



*Figure 4: Draft toroidal label design prescribed in 2012*

Label contents: The draft regulation has mandated the use of a common label design across all appliances covered under the labelling scheme.

- Performance Grade
- Rated Power ( in W)
- Actual Power Consumption (in W)
- Energy consumption per month (in kWh)
- Model number
- Brand name

Any person who is supplying products coming under the broad category of products coming under a Scheduled Appliance are prohibited from using any graphic affixed to the product or in promotional material which imply the Energy Label depicted above without a valid EPC affiliated to such a product. Details of enforcement were not decided.

### ***4.3. Overview of “research study on consumer behaviour” – conducted in 2017***

The Government of Maldives represented by the Ministry of Environment and Energy (MEE), under the project strengthening Low Carbon Energy Island Strategies (LCEI) conducted the research on consumer behaviour and preferences regarding energy efficiency in households. The research study focused on increasing energy efficiency by developing appropriate policies, guidelines and standards, as well as through public education and advocacy.

The objective of this research was to identify, through both quantitative and qualitative study, the perception of general public regarding energy efficiency in selected locations in the Maldives, which would assist the Ministry of Environment and Energy in developing policies, guidelines, standards, and public education and advocacy programs.

A questionnaire was designed to extract essential information on key research areas of the survey, specifically, energy efficiency knowledge, usage patterns, energy efficiency measures taken in the household, factors influencing purchase, barriers to implement energy efficiency measures and readiness to implement energy efficiency measures, which were decided in the pre-inception meeting to form an agenda of the survey. The main qualitative method of data collection for this study was Focus Group Discussions (FGD) among key stakeholders, who had a direct and indirect stake in this Project. After the collection and the analysis of complete data, a comprehensive list of indicators was developed to reflect the baseline situation in relation to the project objectives.

The analysis of the survey responses showed that 72% of the participants were women. More than half of the participants were between the ages of 35-64, followed by 36% falling between the ages of 18-34. Out of the total respondents, 46% had completed technical /vocational training or higher, with 44% of the respondents being formally employed. In most of the cases, the total monthly income of households ranged from MVR 5,001 to MVR 15,000. A significant majority (85%) of the respondents lived in houses as opposed to apartments.



As far as awareness about energy efficiency is concerned, 39% claimed that they understood what energy efficiency encompasses in terms of meaning and effective and efficient usage of energy. Out of total respondents, **85% were not aware about energy efficiency labels or ratings (star ratings)** often depicted on today's consumer products.

The primary factors influencing the purchase of an energy-intensive consumer product were cost (42%), followed by energy consumption (33%) and brand (27%). The respondents sought most of the information related to their decision making and consumer purchasing behaviour through TV (69%), Radio (14%) and Websites (10%).

The main barriers to undertake energy saving measures as conceived from the report were reportedly lack of financial resources (57.2%) and information (51.4%). **However 95% of the respondents were ready and willing to implement these measures with the right information and ease.** A majority 72% were also ready to implement these measures even if they had to pay to participate in an energy efficient program, revealing the general willingness of individuals to implement and participate in energy efficient programs.

The willingness of respondents to adopt low to medium cost, and even high cost energy efficiency measures was one of the key takeaways from the results. This made a major duty for the policy makers to re-develop, enhance and update, enforce, monitor and evaluate existing energy efficiency policies and measures in all sectors. Medium to high cost energy saving measures need to be intensively facilitated to make the consumer more aware about energy labelling and rating for maximum number of products and brands. It was also recommended by the report to make advocacy of energy efficiency of programs and financial incentivisation for the same to be made the top most priority for the markets to help the consumer make a much more informed decision while purchasing a certain product

#### ***4.4. Overview of the “market analysis study” – conducted in 2016-17***

The Ministry of Environment and Energy (MEE) initiated a study in September 2016 titled “**Technical Analysis of Market to Develop Energy Efficiency Labels and Standards Programme in the Maldives**” in order to assess and support government decision making on the most suitable energy efficiency labels and standards for the Maldives. The overall purpose of the market analysis conducted is to support MEE & the government in decision making on the most suitable energy efficiency labels and standards for the Maldives. The report aims to enable meaningful comparisons among appliance types at a macro-level, which are helpful and necessary to policymakers in the further development of energy labelling and energy efficiency standards in the Maldives.

The study sheds light on the monetary value of each appliance type, the quantity of appliances imported, key importers, brands sold, countries of manufacture, countries of shipping origin, annual energy consumption, and forecasted trends for each appliance.

The appliances analysed under the market analysis work includes:

- Air conditioners,
- Refrigerators and freezers,
- Washing machines,
- Televisions,
- Lights,
- Electric ovens,
- Electric water heaters,

- Water pumps, and
- Electric fans.

The following aspects for each appliance mentioned above has been studied in the Maldivian context:

- Quantity imported
- Key importers
- Brands sold
- Countries of manufacture, and countries of shipping origin
- Growth forecasts

The findings from market analysis reports have been studied in detail for three appliances that have been shortlisted for S&L programme i.e. Air conditioners, Refrigerators, and Washing machines. A summary of the most relevant information for these three appliances as per the details presented in the market analysis report are shown next.

#### 4.4.1. Summary of market information for air conditioners

Table below provides summary of market size, trend, key importers, major brands and few technical details for air conditioners in the Maldives.

Table 8: Summary of air conditioner market assessment

AIR CONDITIONERS	
<p><b>Key import figures in 2016</b></p> <p><b>Total import by quantity =&gt; 45,446</b></p> <p><b>Total import by value =&gt; MVR 245 mil.</b></p> <p><b>CAGR (last 5 years) =&gt; 23%</b></p>	<p style="text-align: center;"><b>Imports of air conditioners</b></p>
<p><b>Key import figures in 2010</b></p> <p><b>Total import by quantity =&gt; 20,000</b></p> <p><b>Total import by value =&gt; MVR 115 mil.</b></p>	
<p><b>Major importers in 2016</b></p>	<p><b>Major brands in 2016</b></p> <ul style="list-style-type: none"> <li>• <b>Hitachi</b></li> <li>• <b>Galanz</b></li> <li>• <b>LG</b></li> <li>• <b>Voltas</b></li> <li>• <b>Panasonic</b></li> <li>• <b>Super General</b></li> <li>• <b>Gree</b></li> <li>• <b>Sharp</b></li> <li>• <b>Blue star</b></li> <li>• <b>Mitsubishi</b></li> <li>• <b>Midea</b></li> <li>• <b>Skyworths</b></li> <li>• <b>Daikin</b></li> <li>• <b>Nikai</b></li> </ul>

Top manufacturing countries for AC (2016)			Top shipping countries for AC (2016)		
S. No.	Country	% share	S. No.	Country	% share
1.	China	46	1.	Singapore	31
2.	Malaysia	32	2.	China	20
3.	Thailand	11	3.	Hong Kong	16

#### Other relevant information:

- The most common type of AC imported is wall mount split system.
- Almost 100% were inverter-type models.
- Refrigerant types of all AC were R410A.
- The sizes of AC sold range from 9,000 BTU to 24,000 BTU. **Most popular capacity is 9,000 BTU.**
- **Annual air conditioner imports forecasted to be over 60,000 by 2025**

#### Technical information:

Inverter air conditioners of capacity 9,000BTU and 10,000BTU has the lowest annual energy consumption value with 864.32kWh and 852.64kWh respectively.

The annual energy consumption of 12000BTU air conditioner model ranges between 865 and 1,215kWh.

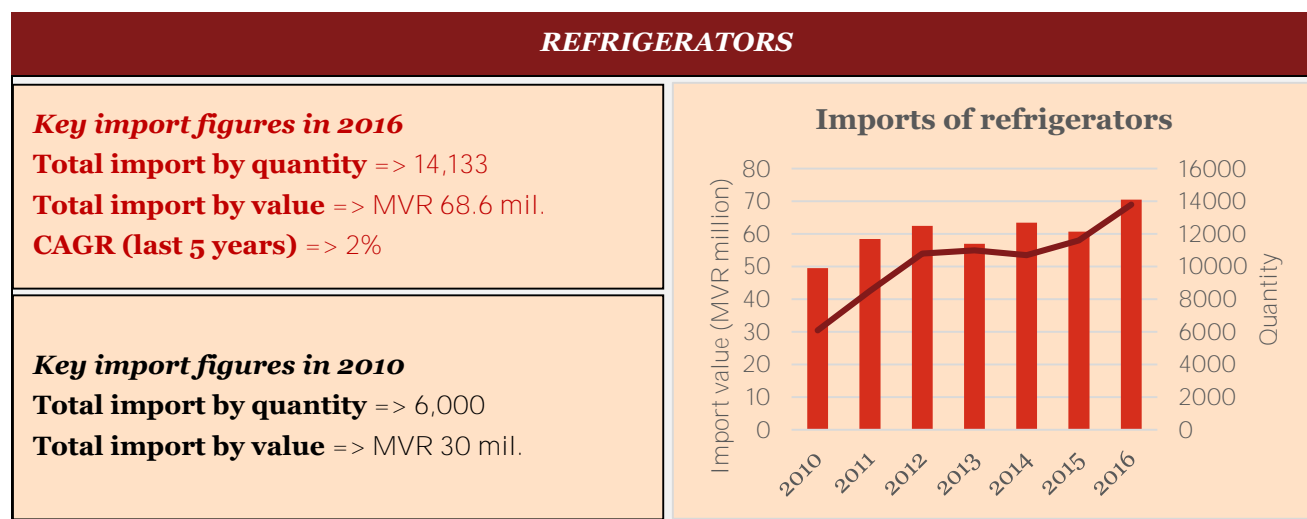
The annual energy consumption of 18000BTU air conditioner model ranges between 1845 and 2005kWh.

Air conditioner of the capacity 24,000BTU has the annual energy consumption value with 8,176.00kWh.

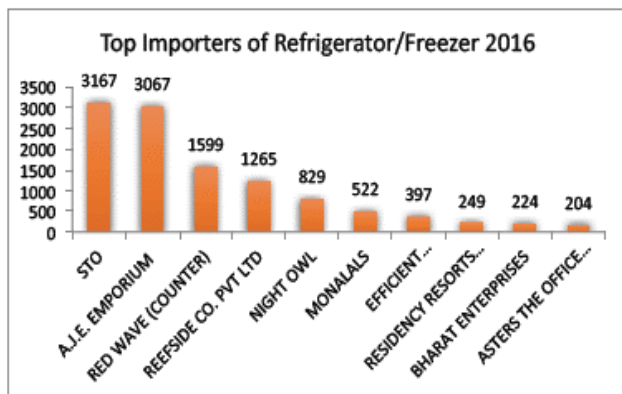
## 4.4.2. Summary of market information for refrigerators

Table below provides summary of market size, trend, key importers, major brands and few technical details for refrigerators in the Maldives.

Table 9: Summary of refrigerator market assessment



### Major importers in 2016



### Major brands in 2016

- **Hitachi**
- **Panasonic**
- **Samsung**
- **Toshiba**
- **Sharp**
- **LG**
- **Whirlpool**
- **Nikai**
- **Super General**
- **Akira**
- **Skyworth**
- **Westpoint**
- **Nikura**

### Top manufacturing countries for refrigerator (2016)

S. No.	Country	% share
1	Thailand	37
2	China	36
3	India	8

### Top shipping countries for refrigerator (2016)

S. No.	Country	% share
1	Singapore	43
2	China	17
3	UAE	17

### Other relevant information:

- Refrigerator-freezer is the most sold type with top mounted freezer, followed by bottom mounted. Side by side are relatively few in the market. 30 out of 81 models surveyed were inverter-type.
- Amongst the models, 17 models had a “Non-CFC” refrigerant. Others include R600a and HFC-134a
- The capacity of the refrigerators ranged from 43 litres to 584 litres. The average total storage volume of refrigerator-freezer purchased in 2016 is 250 litres.
- **Annual refrigerator imports forecasted to be around 15,000 by 2025**

### Technical information:

Refrigerators with the freezer on top and with capacity 240L, 260L and 330L had the lowest annual energy consumption value with 131.40kWh. These are inverter refrigerators imported and manufactured in India. Refrigerator of capacity 601L had the highest annual energy consumption value with 635kWh.

### 4.4.3. Summary of market information for washing machines

Table below provides summary of market size, trend, key importers, major brands and few technical details for washing machines in the Maldives.

Table 10: Summary of washing machine market assessment

WASHING MACHINES																													
<p><b>Key import figures in 2016</b>  <b>Total import by quantity</b> =&gt; 15,168  <b>Total import by value</b> =&gt; MVR 35.5 mil.  <b>CAGR (last 5 years)</b> =&gt; almost zero</p>			<table border="1"> <caption>Imports of washing machines (2010-2016)</caption> <thead> <tr> <th>Year</th> <th>Quantity</th> <th>Import value (MVR million)</th> </tr> </thead> <tbody> <tr><td>2010</td><td>~10000</td><td>~25</td></tr> <tr><td>2011</td><td>~12000</td><td>~30</td></tr> <tr><td>2012</td><td>~14000</td><td>~38</td></tr> <tr><td>2013</td><td>~15000</td><td>~35</td></tr> <tr><td>2014</td><td>~16000</td><td>~40</td></tr> <tr><td>2015</td><td>~17000</td><td>~45</td></tr> <tr><td>2016</td><td>~15000</td><td>~38</td></tr> </tbody> </table>			Year	Quantity	Import value (MVR million)	2010	~10000	~25	2011	~12000	~30	2012	~14000	~38	2013	~15000	~35	2014	~16000	~40	2015	~17000	~45	2016	~15000	~38
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<p><b>Major importers in 2016</b></p> <table border="1"> <caption>Top Importers of Washing Machine 2016</caption> <thead> <tr> <th>Importer</th> <th>Quantity</th> </tr> </thead> <tbody> <tr><td>EFFICIENT ELECTRONICS</td><td>3511</td></tr> <tr><td>RED WAVE (COUNTER)</td><td>2392</td></tr> <tr><td>STO</td><td>2069</td></tr> <tr><td>REEFSIDE CO. PVT LTD</td><td>1570</td></tr> <tr><td>A.J.E. EMPORIUM</td><td>1297</td></tr> <tr><td>AA SYSTEM...</td><td>1022</td></tr> <tr><td>NIGHT OWL</td><td>501</td></tr> <tr><td>LINTEL INVT. &amp;...</td><td>334</td></tr> <tr><td>MERIDIAM SERVICES...</td><td>281</td></tr> <tr><td>MONALALS</td><td>238</td></tr> </tbody> </table>			Importer	Quantity	EFFICIENT ELECTRONICS	3511	RED WAVE (COUNTER)	2392	STO	2069	REEFSIDE CO. PVT LTD	1570	A.J.E. EMPORIUM	1297	AA SYSTEM...	1022	NIGHT OWL	501	LINTEL INVT. &...	334	MERIDIAM SERVICES...	281	MONALALS	238	<p><b>Major brands in 2016</b></p> <ul style="list-style-type: none"> <li>• <b>Panasonic</b></li> <li>• <b>Super general</b></li> <li>• <b>Toshiba</b></li> <li>• <b>LG</b></li> <li>• <b>Geepas</b></li> <li>• <b>Nikai</b></li> <li>• <b>Samsung</b></li> <li>• <b>Sharp</b></li> <li>• <b>Lanza</b></li> <li>• <b>Singsung</b></li> <li>• <b>Hitachi</b></li> <li>• <b>Whirlpool</b></li> <li>• <b>Beko</b></li> </ul>				
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<p><b>Other relevant information:</b></p> <ul style="list-style-type: none"> <li>• Top loaders are dominant in the market.</li> <li>• Most products are in the range of 5kg to 14kg capacity.</li> <li>• Washing machine imports forecasted to be around 25,000 by 2025.</li> <li>• <b>Nearly all households contain at least one washing machine that is operating a minimum of once a week</b></li> </ul>																													
<p><b>Technical information:</b>                      Average energy consumption for washing machines is 160kWh/year                      an inverter front load auto washing machine had the least annual energy consumption with 122kWh (7 kg, A+++ EU label)</p>																													

A non-inverter auto top load washing machine had the highest annual energy consumption with 184.32kWh (10 kg, 5 star Thailand label)

## 4.5. Key takeaways

### 4.5.1. Study for manual for official recommended electric appliances

The recommended program was essentially an endorsement labelling scheme that sought to create market differentiation among appliances affixed with a label of one of 9 countries. **The status of “Officially recommended appliance” would be provided to appliances with the highest within a country’s program.**

The manual provided several important inputs which would support the team in development of the labelling program. It further reinforced our belief that international programs are of paramount importance in this process.

However, while the endorsement labelling program would have been relatively easy to implement, the **voluntary nature of the program** was such that there were few aspects which caused inherent drawbacks. These aspects include:

- **Retailers were responsible to get the approval from MHTE for use of the sticker.** Traditionally, the incentive to get models labelled lies with the manufacturer of appliances. However, given the import driven nature of the market, there is little incentive for retailers to affix the label.
- From an implementation point of view, since **the program will be dependent on other countries, there is minimum flexibility with the program authority (MHTE).**
- Also, given the **heterogeneous nature of the labelling programs in different countries**, appliances failing to qualify through a strict program could also qualify by applying through a more lenient program.
- Additionally, as different programs adhere to different test standards & labelling criteria, inter-comparability among models adhering to different programs is not possible.

Given these observations, we believe that any such program would face roadblocks during design and implementation in the Maldives. Therefore, we suggest that in an import driven **market such as the Maldives**, the ideal way forward is a **homogeneous labelling program** or a **MEPS scheme**.

### 4.5.2. Study for draft energy labelling regulation

The study of the consultation paper brought out extremely relevant information on the background for development of a labelling program in the Maldives. The draft energy regulation provided a brief insight on the work done in 2011-12 for development of the labelling scheme.

While the results of these studies provide limited actionable material for the labelling program development process, few important observations were made by the team:

- Details such as determination of labelling bands for a particular appliance, implementation mechanism, M&V procedure etc. were not captured in the draft regulation. In our opinions, these aspects are of paramount importance for the success of a labelling program in a country.
- Moreover, the toroidal design of the label, while adhering to the generally accepted principles of labelling, was different from global best practices. This would provide room for unnecessary complications in readability of the label, among other aspects.

Given these observations, there is a need to revisit not only the design of the label, but also import aspects such as labelling criteria, implementation procedure, and enforcement mechanisms.

### **4.5.3. Study for research on consumer behaviour**

The research on consumer behaviour and preferences regarding energy efficiency in households focused on **identifying the perception of general public regarding energy efficiency in selected locations in the Maldives**, which would assist the Ministry of Environment and Energy in developing policies, guidelines, standards, and public education and advocacy programs.

The study brought out several important outcomes to assess the overall success of the labelling program in the country. Important results included that **85% of consumers were not aware about energy efficiency labels or ratings (star ratings)** often depicted on today's consumer products. Also, the main barriers to undertake energy saving measures as conceived from the report were reportedly lack of financial resources (57.2%) and information (51.4%). **However 95% of the respondents were ready and willing to implement these measures with the right information and ease**

**This suggests that there remains scope for very high market acceptability of the labelling program for appliances in the Maldives, and high chance for successfully transforming the market towards energy efficiency.**

However, the results of the survey come with a few caveats. They include:

- The survey conducted mostly focused on a consumers' point of view. While this is extremely relevant to the present context, the exact savings potential from the labelling scheme cannot be quantitatively assessed using the present information.
- Another important aspect (from a labelling point of view) not covered in the report is the perspective of other stakeholders such as retailers/importers. **There remains a need for assessing their dynamics to come out with an effective roll out strategy for the labelling program, and ensure that only efficient appliances reach the consumers at a reasonable cost.**

### **4.5.4. Study for market analysis**

Market analysis is one of the most important steps in development of a standards and labelling programme. Typically, a market analysis includes, information about appliances prevalent in an economy; classification of appliances; key brands and types available; annual consumption of appliances in the economy; key technical specifications of the appliances; present efficiency levels, availability of standard as well as efficient models, local manufacturing, import share, and projected market growth etc. This entire information not only facilitates in **capturing the real picture of country's market for a respective appliance but also facilitates in design & development energy standards and labelling scheme.** The results of the market analysis often provide a starting point for completing the other crucial steps in development of a labelling program.

One the key initial steps for the market analysis is to assess the share /capacity of local manufacturing with that of import of appliances. The economies where the appliances under the consideration of energy efficiency schemes are locally manufactured in significant numbers, the governments usually attempts to create standards which are focused on efficient technologies as well as provides opportunities to local manufacturers to make gradual advancements in the overall value chain of products. On the other hand, **for import driven economies the focus is usually on introduction of measures through which efficient technologies could be promoted and import of inferior products could be avoided.** The collection of market data in

both cases is very important for the design of standards and labelling programme. However, the data collection methodology slightly differs in both cases.

In the case of the Maldives, as the market is entirely import-driven, the local manufacturing and/or assembly of appliances is negligible. Therefore, import data is a good estimate of the local market in the country. The data for appliances which are imported in the country could be obtained from customs and local importers.

The market analysis report shared by MEA has extremely relevant information regarding the import numbers, forecasts, source countries, brands sold, and major importers in the Maldives market. However, the development of a labelling programme would require some more details on aspects such as type-wise segregation, capacity-wise segregation etc. This information is extremely important because of the following reasons:

- Unless the information on type and capacity wise appliances is available the scope of programme will remain generic and will not be realistic,
- The comparison of local market with that of markets in other countries will not be feasible,
- The data will facilitate in assessing the technical parameters in a better manner, etc.

The information required is summarized below:

*Table 11: Summary of additional information required and proposed approaches for data collection*

S. No.	Information required and relevant stakeholders for the data	
1.	Type-wise segregation for the appliances for example: market information about semi-automatic, fully-auto top loading and fully-auto front loading machines	Retailers /importers in the Maldives
2.	Capacity-wise segregation for the appliances for example: market information for washing machine of different loading such as for 5 kg, 5.5 kg etc.	
3.	Segregation of import /sales of 3 appliances by efficiency grades. For example, what is the share of 5-star labelled appliances sold in Maldives?	
4.	Details displayed on the various labels	

In order to obtain the data for the points tabulated, a questionnaire based survey method is proposed. The draft questionnaires for respective appliances which have been prepared and circulated to the local importers in Maldives for their inputs and suggestions is enclosed in **Annexure A**.



# 5. Market analysis: summary of data sought from importers

## 5.1. Details of questionnaire based responses received from key importers in the Maldives

### 5.1.1. Air conditioner survey

The sample questionnaire was shared with all major importers in Maldives. Responses were received from 6 major importers – Lintel, STO, Monalals, Refcool, Reefside, and AJE Emporium. A summary of information received is shown below.

Table 12: Summary of responses received against the air conditioner questionnaire

	Lintel		STO		Monalals		Refcool		Reefside		AJE Emporium	
<b>Segmentation of split &amp; window ACs</b>	Window type – 0% Split type (variable speed) – 100%		Window type – 0% Split type – 100%		Window type – 0% Split type (variable speed) – 100%		Window type (variable speed) – 10% Split type (variable speed) – 90%		Split type - variable speed 100%		Window type – 0% Split type (variable speed) – 100%	
<b>Segmentation of Window ACs by capacity</b>	Capacity range (Btu/hr)	%	Capacity range (Btu/hr)	%	Capacity range (Btu/hr)	%	Capacity range (Btu/hr)	%	Capacity range (Btu/hr)	%	Capacity range (Btu/hr)	%
	-	-	-	-	-	-	9K to 12K	50%	-	-	-	-
							12K to 18K	50%				
<b>Segmentation of Split ACs by capacity</b>	Upto 9K	17%	Upto 9K	-	Upto 9K	-	Upto 9K	-	Upto 9K	-	Upto 9K	-
	9K to 12K	53%	9K to 12K	35 %	9K to 12K	60%	9K to 12K	50%	9K to 12K	50%	9K to 12K	30%
	12K to 18K	14%	12K to 18K	38 %	12K to 18K	30%	12K to 18K	20%	12K to 18K	30%	12K to 18K	35%
	18K to 24K	17%	18K to 24K	18 %	18K to 24K	10%	18K to 24K	20%	18K to 24K	20%	18K to 24K	20%
	24K+	-	24K+	11%	24K+	-	24K+	10%	24K+	10%	24K+	15%
<b>Main exporting countries for fixed speed (window ACs)</b>	-		-		-		-		-		-	
<b>Main exporting countries for fixed speed (split ACs)</b>	-		Singapore (100%)		-		-		-		-	
<b>Main exporting countries for variable</b>	-		-		-		China (90%) Singapore (5%) Malaysia (5%)		-		-	

<b>speed (window ACs)</b>						
<b>Main exporting countries for variable speed (split ACs)</b>	Malaysia India China	Singapore (100%)	Singapore (100%)	China (90%) Singapore (5%) Malaysia (5%)	China (60%) India (30%) Vietnam (10%)	Malaysia (50%) Singapore (40%) China (10%)
<b>Are energy efficiency labels present?</b>	Yes (5-star rated)	Few models with 5-star rating	-	No	3-star	No
<b>Main purchasing criteria</b>	Price Energy consumption Aesthetics	Price Energy consumption Features	Energy consumption Price Aesthetics	Price Energy consumption Features	Price Aesthetics Features	Price Energy consumption Features

Responses received by the importers suggest that the market for ACs in the Maldives is mostly comprised on variable speed (inverter type) split air conditioners. The market for fixed speed seems to be negligible in the recent years.

The capacity ranges from 9000 Btu/hr to 24000 Btu/hr. The majority seems to lie in the 9000 to 18000 Btu/hr bracket. **Therefore, the scope for the labelling program in the Maldives should at least cover this segment of the market.**

The majority of imports reported are from Singapore, followed by China and India. It was also reported that energy efficiency labels are present in few models, which seem to have the highest efficiency.

**This indicates that energy efficiency labels for air conditioners is not something new in the Maldives. Therefore, the potential labelling program for air conditioners has sufficient market acceptability, especially among consumers.**

Also, the main purchasing criteria for air conditioners was found consistent by all importers – price, energy and aesthetics. This indicates that introduction of an energy efficiency/ ODP label will likely support consumers in undertaking an informed choice during purchase. **This also indicates that the timing for introduction of a labelling program for this appliance is appropriate.**

### 5.1.2. Refrigerator survey

Responses were received from 5 major importers – STO, Monalals, Refcool, Reefside, and AJE Emporium. Out of these, only 4 importers duly filled the information asked in the questionnaires. A summary of information received is shown below.

*Table 13: Summary of responses received against the refrigerator questionnaire*

	STO		Monalals		Reefside		AJE Emporium	
<b>Segmentation of refrigerator import /sales in FY 2017 by type</b>	Absorption type – 0% Compression type – 100%		Absorption type – 0% Compression type – 100%		Absorption type – 0% Compression type – 100%		Absorption type – 0% Compression type – 100%	
	Machine Type	%	Machine Type	%	Machine Type	%	Machine Type	%

<b>Another way of segmentation of refrigerator import /sales in FY 2017 by type</b>	Single door (direct cool)	0.00 %	Single door (direct cool)	60.00 %	Single door (direct cool)	30.00 %	Single door (direct cool)	10.00 %				
	Double door (frost free) with freezer section on the top	57.01 %	Double door (frost free) with freezer section on the top	40.00 %	Double door (frost free) with freezer section on the top	40.00 %	Double door (frost free) with freezer section on the top	86.00 %				
	Three door	10.46 %	Three door	0.00 %	Three door	30.00 %	Three door	2.00 %				
	Side-by-Side (multi door)	2.55 %	Side-by-Side (multi door)	0.00 %	Side-by-Side (multi door)	0.00 %	Side-by-Side (multi door)	2.00 %				
	Others	29.98 %	Others	0.00 %	Others	0.00 %	Others					
	Others		Others		Others		Others					
<b>Segmentation of compression-type refrigerator sales in FY 2017 by capacity (Gross Volume)</b>	Capacity range (Gross volume in Litres)	%	Capacity range (Gross volume in Litres)	%	Capacity range (Gross volume in Litres)	%	Capacity range (Gross volume in Litres)	%				
	Less than 100	0.0 %	Less than 100	0.00%	Less than 100	60.00 %	Less than 100	8.00 %				
	> 100 & ≤ 200	16.80 %	> 100 & ≤ 200	0.00%	> 100 & ≤ 200	10.00 %	> 100 & ≤ 200	70.0 %				
	> 200 & ≤ 300	29.05%					> 200	22.0 %				
300 above	54.15%											
<b>Details of capacity of each type of refrigerator</b>	Type	Gross volume in L	Percentage	Type	Gross volume in L	Percentage	Type	Gross volume in L	Percentage	Type	Gross volume in L	Percentage
	Single door (direct cool)	≤ 100	0.00 %	Single door (direct cool)	≤ 100	50.00 %	Single door (direct cool)	≤ 100	60.00 %	Single door (direct cool)	≤ 100	80.00 %
		> 100 & ≤ 200	0.00 %		> 100 & ≤ 200	50.00 %		> 100 & ≤ 200	5.00 %		> 100 & ≤ 200	20.00 %
		> 200 & ≤ 300	0.00 %		> 200 & ≤ 300	0.00 %		> 200 & ≤ 300	15.00 %		> 200 & ≤ 300	
		300 above	0.00 %		300 above	0.00 %		300 above	15.00 %		300 above	
	Double door (frost free) with freezer section on the top	≤ 200	29.00 %	Double door (frost free) with freezer section on the top	≤ 200	53.00 %	Double door (frost free) with freezer section on the top	≤ 200	0.00 %	Double door (frost free) with freezer section on the top	≤ 200	55.00 %
		> 200 & ≤ 250	12.00 %		> 200 & ≤ 250	0.00 %		> 200 & ≤ 250	0.00 %		> 200 & ≤ 250	45.00 %
		> 250 & ≤ 300	51.00 %		> 250 & ≤ 300	30.00 %		> 250 & ≤ 300	10.00 %		> 250 & ≤ 300	90.00 %
		> 300 & ≤ 350	0.00 %		> 300 & ≤ 350	8.00 %		> 300 & ≤ 350	25.00 %		> 300 & ≤ 350	10.00 %
		> 350 & ≤ 400	0.00 %		> 350 & ≤ 400	7.00 %		> 350 & ≤ 400	25.00 %		> 350 & ≤ 400	
		> 400 & ≤ 500	3.00 %		> 400 & ≤ 500	2.00 %		> 400 & ≤ 500	10.00 %		> 400 & ≤ 500	
		> 500	5.00 %		> 500	0.00 %		> 500	5.00 %		> 500	
		Three door	>300 & ≤ 400		6.00 %	Three door		>300 & ≤ 400	N.A.		Three door	>300 & ≤ 400

		>400 & ≤ 650	94.00 %		>400 & ≤ 650			>400 & ≤ 650				
	Side-by-Side (multi door)	500<	100 %	Side-by-Side (multi door)	500<	N.A.	Side-by-Side (multi door)		0.00 %	Side-by-Side (multi door)	800	100.00 %
	Others		N.A.	Others		N.A.	Others		N.A.	Others		N.A.
<b>Top 3 absorption-type refrigerators importers</b>	N.A.		N.A.		N.A.		N.A.		N.A.			
<b>Top 3 compression-type refrigerators importers</b>	Singapore (100%)		Singapore (79.00%) Dubai (21.00 %)		India (60.00 %) China (20.00 %) Dubai (20.00 %)		Singapore (80.00 %) Dubai (20.00 %)					
<b>Presence of energy efficient labels on refrigerators sold in the Maldives</b>	No		No		3 stars		No					
<b>Main purchasing criteria for a consumer while purchasing a refrigerator</b>	Rank	Criteria	Rank	Criteria	Rank	Criteria	Rank	Criteria				
	1	Price	1	Price	1	Price	1	Price				
	2	Energy Consumption	2	Features	2	Aesthetics	2	Energy Consumption				
	3	Aesthetics	3	Aesthetics	3	Features	3	Features				
	4	Features	4	Energy Consumption	4	Energy Consumption	4	ODP				
	5	ODP	5	ODP	5	ODP	5	Aesthetics				

Responses received by the importers suggest that the market for refrigerators in the Maldives mostly consists of direct cool single door and frost free double door refrigerator, with freezer on the top. The entire market has the presence of compression type refrigerators only. The presence of three door refrigerator is less as compared to the above two refrigerators. The market for side-by-side (multi-door) seems to be negligible. The capacity ranges from less than 100l to upto 650l. The majority seems to lie in the 100l-400l bracket.

**Therefore, the scope for the labelling program in the Maldives should at least cover this segment of the market.**

The majority of imports reported are from Singapore, followed by Dubai (UAE), India and China.

The energy efficiency labels are present on very few models, which seem to have a moderate energy efficiency (3 stars). This is mostly limited to the compression type refrigerators imported from India of capacity 100l-300l.

**This indicates that energy efficiency labels for refrigerators are not strongly established in the Maldives. Therefore, the potential labelling program for refrigerators has to be drafted keeping in mind the less acceptability of energy labels by the importers and dearth of consumer awareness about energy labels for refrigerators.**

Also, the main purchasing criteria for refrigerators was found consistent by all importers – price, features and aesthetics. This indicates that the consumers are more inclined to make an informed decision, based upon the features and price during the purchase of a refrigerator. The introduction of an energy efficiency label will make

consumers more aware about the features and energy efficiency of the refrigerators. **This also indicates that the timing for introduction of a labelling program for this appliance is appropriate.**

### 5.1.3. Washing machine survey

Responses were received from 6 major importers – Lintel, STO, Monalals, Refcool, Reefside, and AJE Emporium. A summary of information received is shown below.

*Table 14: Summary of responses received against the washing machine questionnaire*

	Lintel		STO		Monalals		Refcool <sup>6</sup>		Reefside		AJE Emporium	
<b>Segmentation of washing machine sales</b>	Semi-auto – 0% Top-loader – 18% Front-loader – 82%		Semi-auto – 33% Top-loader – 52% Front-loader – 15%		Semi-auto – 45% Top-loader – 50% Front-loader – 5%		-		Semi-auto – 5% Top-loader – 40% Front-loader – 40% Washer-dryer – 15%		Semi-auto – 15% Top-loader – 50% Front-loader – 30% Washer-dryer – 5%	
<b>Segmentation of washing machines by capacity</b>	Capacity range (kg)	%	Capacity range (kg)	%	Capacity range (kg)	%	Capacity range (kg)	%	Capacity range (kg)	%	Capacity range (kg)	%
	6 – 8	100 %	7 - 8 8 - 9 9-10 11-14 >15	38 % 14 % 33 % 12 % 3 %	<5 6-8	5% 95%	-	-	<5 6-8	30% 70%	<5 6-8 Above 8	- 95% 5%
<b>Main exporting countries for twin tubs</b>	-		Singapore (98%) China (2%)		Singapore (60%) Dubai (40%)		China		India (50%) China (25%) Dubai (25%)		China (95%) Dubai (5%)	
<b>Main exporting countries for top loaders</b>	India		Singapore (98%) China (2%)		Singapore (100%)		China		India (50%) China (25%) Dubai (25%)		Singapore (70%) India (30%)	
<b>Main exporting countries for front loaders</b>	Germany (55%) Turkey (45%)		Singapore (100%)		Singapore (33%) Dubai (67%)		-		India (50%) China (25%) Dubai (25%)		Dubai (100%)	
<b>Main exporting countries for washer dryers</b>	-		-		-		-		India (50%) China (25%) Dubai (25%)		Dubai (100%)	
<b>Are energy efficiency labels present?</b>	Yes (5-star rated)		No		LG top loader – 3 ticks Sharp top loader – 3 ticks		No		3-star		No	
<b>Main purchasing criteria for consumers</b>	Price Energy consumption Water consumption		Price Energy consumption Water consumption		Features Price Energy consumption		Price Water consumption Features		Price Aesthetics Features		Price Energy consumption Water consumption	

<sup>6</sup> The information provided in the response seems to be inconsistent. Therefore, this information has not been considered in the analysis.

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The market for washing machines in the Maldives is more evenly distributed than that for ACs. There is adequate imports of all types of washing machines, including semi-automatic machines (twin tubs), top loaders and front loaders. *The market for washer dryers seem to be negligible.* The capacity ranges from 5 kg to 15 kg, with 6-8 kg having the highest market share.

**This indicates that the scope of the labelling program for washing machines will be wide, and would include all types of washing machines.**

Here, as in the case for air conditioners, the imports are dominated by Singapore, followed by China and India. However, Lintel has considerable imports from Germany and Turkey for front loaders. However, energy efficiency labels are generally not present on washing machines.

Also, the main purchasing criteria for washing machines was found consistent by all importers – price, energy and water consumption. This indicates that introduction of an energy efficiency/ water efficiency label will likely support consumers in undertaking an informed choice during purchase.

**As consumers are generally now aware of labels on washing machines, the program will provide the necessary information to the consumer to make an informed choice. Also, since the consumers are already opting to purchase efficient products, the labelling program is likely to have high market acceptability.**

# 6. Analysis of global programs for the three appliances

## 6.1. Selection of countries for assessment of international S&L programs

The majority of appliances sold in the Maldives' market are imported. Naturally, the performance and energy efficiencies of each model of an appliance depends on the source countries' norms and regulations. Therefore, it becomes important to assess the existing efficiency levels of appliances sold in the market, and the various regulations followed. This is accomplished through this exercise.

The overall flow of activities is shown in the following figure:

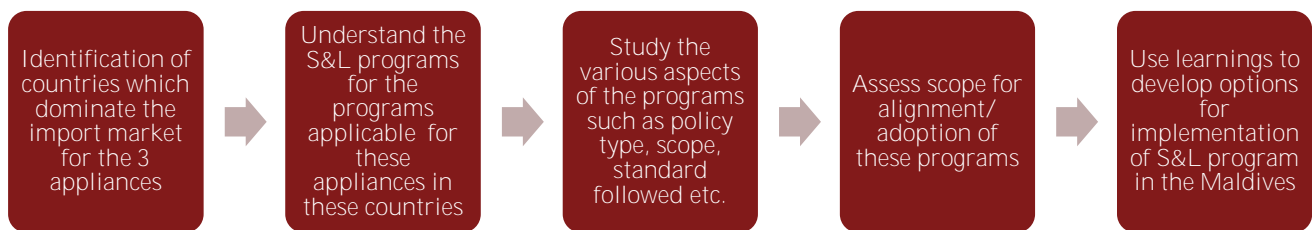
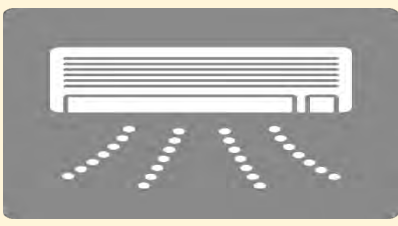
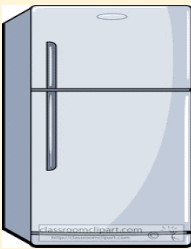



Figure 5: Approach for selection of countries for international assessment

The major countries from which import of the 3 appliances take place are shown in the following table. *The results are based on the import statistics of 2016 as reported in the market assessment report.*

Table 15: Summary of import details for the three appliances

 Air-conditioners			 Refrigerators			 Washing machines		
Country	% by country of shipping	% by country of manufacture	Country	% by country of shipping	% by country of manufacture	Country	% by country of shipping	% by country of manufacture
China	20%	46%	China	17%	36%	China	44%	58%
Singapore	31%	-	Singapore	43%	7%	Singapore	22%	-
Hong Kong	16%	-	UAE	17%	-	UAE	19%	-
Malaysia	12%	32%	Thailand	10%	37%	Thailand	4%	17%
India	11%	-	India	8%	8%			
Thailand	-	11%						

The team identified the presence of energy efficiency programme for the respective appliances in these countries. The summary of programmes is shared below:

*Table 16: Summary of international S&L programs considered for further assessment*

Air-conditioners			Refrigerators			Washing machines		
Country	Program type	Voluntary or mandatory	Country	Program type	Voluntary or mandatory	Country	Program type	Voluntary or mandatory
<b>China</b>	Label comparative Label endorsement MEPS	Mandatory	<b>China</b>	Label comparative Label endorsement MEPS	Mandatory	<b>China</b>	Label comparative Label endorsement MEPS	Mandatory
<b>Singapore</b>	Label comparative	Mandatory	<b>Singapore</b>	Label comparative	Mandatory	<b>Singapore</b>	Label comparative	Mandatory
<b>Hong Kong</b>	Label comparative MEPS	Mandatory	<b>Malaysia</b>	Label comparative MEPS	Mandatory	<b>UAE</b>	Label comparative MEPS	Mandatory
<b>Malaysia</b>	Label comparative MEPS	Mandatory	<b>Thailand</b>	Label comparative Label voluntary MEPS	Voluntary	<b>Thailand</b>	Label comparative Label voluntary MEPS	Voluntary
<b>India</b>	Label comparative MEPS	Mandatory	<b>India</b>	Label comparative MEPS	Mandatory			
<b>Thailand</b>	Label comparative Label voluntary MEPS	Voluntary						

This chapter provides a detailed assessment of the overall procedures, technical and general aspects of the various standards and labelling programs for the three appliances ongoing in countries which are major sources of import of air conditioners, refrigerators and washing machines into the Maldives. The countries/geographic regions include China, Hong Kong, India, Malaysia, Singapore, Thailand, and the UAE (appliance-wise as mentioned above)

The general aspects captured in the assessment include the program type, program scope, implementing organization, label details such as grading criteria, parameters displayed on the label, and minimum qualification requirements, if any. Assessment of technical details include test standards prescribed, parameter based on which the label grade for a model is determined, and, where possible, the prescribed test conditions under which the testing is done. Details on climate and market segmentation in the country/region are also covered for a few programs.

The international program assessment is followed by a summary and an analysis to determine the most suitable program for adoption in the Maldives. The detailed recommendations for the Maldives are described in following chapters.



## 6.2. Air conditioners

### 6.2.1. Air conditioner programme in China

Air conditioners have been the focus of energy efficiency initiatives in China since the year 2000, the year MEPS were first established for fixed speed air conditioners. The MEPS requirements were subsequently revised in 2004. In 2005, the government introduced a mandatory comparative labelling program for fixed speed air conditioners. It sets 5 energy efficiency tiers and took Energy Efficiency Ratio<sup>7</sup> (EER), cooling capacity and power as the main parameters shown on the label.

In 2008, the government established MEPS for variable speed air conditioners. The energy labelling scheme for variable speed air-conditioners began in 2009 based on GB 21455-2008. It sets 5 energy efficiency tiers and took Seasonal Energy Efficiency Ratio<sup>8</sup> (SEER), cooling capacity and cooling season electricity consumption as the main parameters shown on the label.

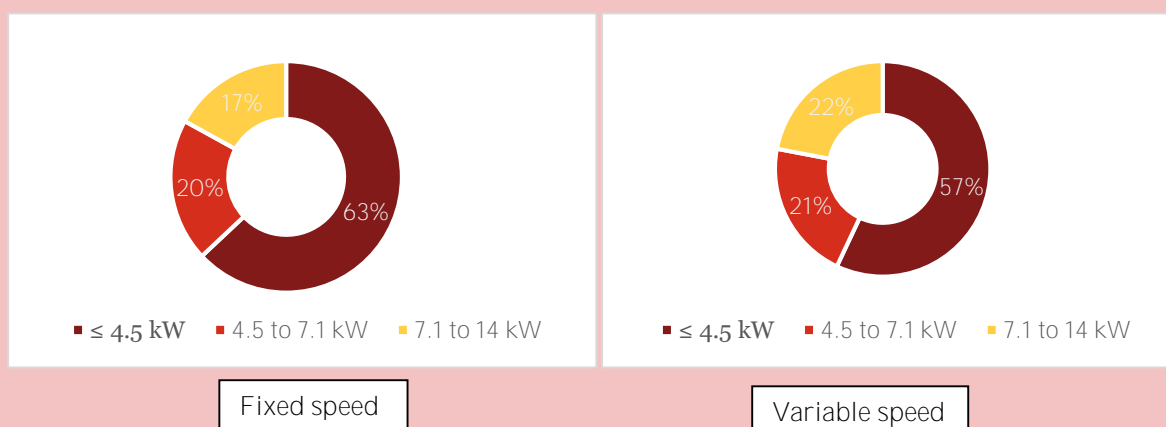
However, since then, the design of the mandatory comparative label has changed from 5-tiers to 3-tiers for both fixed speed and variable speed air conditioners. The revision for fixed speed air conditioners occurred in 2010, and that for variable speed occurred in 2013. The value of the MEPS for both fixed speed and Variable Speed air conditioners have been aligned with the one prescribed by Tier 3 of the respective labels.

China has also implemented a voluntary energy conservation certification scheme for fixed speed air conditioners in 2000. The certification scheme for variable speed air conditioner was established in 2009. Any model with a rating of Tier 2 in the comparative label is eligible for the label.

#### Air conditioner market in China

There are two main air conditioner technologies in the Chinese market: 1) fixed-speed air conditioners, and 2) variable-speed air conditioners. At present, fixed speed air conditioners form the majority at 60% of the market, whereas 40% is held by Variable Speed air conditioners. However, existing trends suggest that Variable Speed air conditioners will soon become the dominant technology.

Air-conditioners are also classified into three sub-categories based on the cooling capacity of air-conditioners: below 4.5 kW, between 4.5 kW and 7.1 kW and between 7.1 kW and 14 kW. **Air-conditioners with a cooling capacity above 14 kW are not considered residential air conditioners.** The segregation of the Chinese market in terms of capacity is shown below<sup>9</sup>:



Air conditioners are also classified into split type and window type (single package type). Split-air conditioning is most widely used. In terms of indoor components, there are wall-mounted and freestanding split air conditioners. In general,

<sup>7</sup> EER is calculated as tested cooling capacity divided by effective input power (unit: W/W).



<sup>8</sup> SEER is the cooling output during a typical cooling-season divided by the total electric energy input during the same period. The seasonal energy efficiency ratio (SEER represents the expected overall performance for a typical year's weather in a given location.

<sup>9</sup> Source: BigEE, Energy efficient Air-conditioners in China, 2014

the cooling capacity of wall-mounted air conditioner is below 5 kW and that of free-standing air conditioners is above 5 kW.

The details of active programs are summarized below:

*Table 17: Details of labelling programs in China for air conditioners*

<b>Label design</b>		
	<b>Comparative label</b>	<b>Endorsement label</b>
<b>Program type</b>	Mandatory	Voluntary
<b>Scope</b>	All residential air conditioners are defined as those ACs with capacities upto 14 kW. Includes both fixed speed and variable speed air conditioners.	
<b>Active since</b>	<ul style="list-style-type: none"> <li>• 2004 (Fixed Speed air conditioners)</li> <li>• 2009 (Variable Speed air conditioners)</li> </ul>	<ul style="list-style-type: none"> <li>• 2000 (Fixed Speed air conditioners)</li> <li>• 2009 (Variable Speed air conditioners)</li> </ul>
<b>Implementing body</b>	<b>China Energy Label Center (CNIS)</b>	
<b>Key stakeholders</b>	AQSIQ and CNCA for organization and appointment of local authorities, which along with NDRC, are responsible for organization of market inspection activities.	
<b>Parameters graded</b>	Energy Efficiency	-
<b>Label Band range</b>	Tier 1 (best) to Tier 3 (worst)	-
<b>Parameters displayed on the label</b>	<ul style="list-style-type: none"> <li>• EER/SEER/APF<sup>10</sup></li> <li>• Cooling capacity</li> <li>• Power output</li> </ul>	-
<b>Minimum qualification requirements</b>	MEPS value	Energy Efficiency corresponding to Tier 2
<b>Tests prescribed</b>	<p><b>For fixed speed air conditioners:</b></p> <ul style="list-style-type: none"> <li>• Energy Efficiency Ratio (EER)</li> </ul> <p><b>For Variable Speed air conditioners:</b></p> <ul style="list-style-type: none"> <li>• Seasonal energy efficiency ratio (SEER)</li> <li>• Heating seasonal performance factor (HSPF)</li> <li>• Annual Performance Factor (APF)</li> </ul>	

<sup>10</sup> Explained below

### Labelling bands for air conditioners with only cooling functions

GB 12021.3 adopts energy efficiency ratio (EER) as the energy performance indicator for fixed speed air conditioners. EER is the value of tested cooling capacity divided by effective input power (unit: W/W). Heating performance is not included in this standard.

GB 21455 adopts seasonal energy efficiency ratio (SEER) as the energy efficiency indicator for cooling performance and heating seasonal performance factor (HSPF) as the heating performance indicator for variable speed air conditioners. SEER is also the EER expressed in Wh/Wh, but instead of being evaluated at a single operating condition, it represents the expected overall performance for a typical year's weather in a given location.

*Table 18: Grading scheme for air conditioners without heating function*

Tier	FIXED SPEED air conditioners EER values (W/W)			VARIABLE SPEED air conditioners SEER values (Wh/Wh)		
	Upto 4.5 kW	4.5 to 7.1 kW	7.1 to 14 kW	Upto 4.5 kW	4.5 to 7.1 kW	7.1 to 14 kW
<b>1</b>	3.6	3.5	3.4	5.4	5.1	4.7
<b>2</b>	3.4	3.3	3.2	5.0	4.4	4.0
<b>3</b>	3.2	3.1	3	4.3	3.9	3.5

### Labelling bands for Variable Speed air conditioners with heating function

For variable speed air conditioners with both cooling and heating functions, an integrated indicator named annual performance factor (APF) is adopted as the only performance indicators.

*Table 19: Grading scheme for variable speed air conditioners with heating function*

Tier	Variable Speed AC APF values (Wh/Wh)		
	Upto 4.5 kW	4.5 to 7.1 kW	7.1 to 14 kW
<b>1</b>	4.5	4.0	3.7
<b>2</b>	4.0	3.5	3.0
<b>3</b>	3.5	3.3	3.1

### Description of test procedure

GB/T 7725 Room Air Conditioners regulates the testing method for air-conditioners and defines the energy efficiency indicators for all air conditioners. Fixed speed and variable speed air-conditioners adopt different energy efficiency indicators and testing methods.

GB 21455-2013 regulates the different cooling and heating time and temperatures to calculate SEER, HSPF and APF. **The total annual cooling time applied is 1136 hours and the annual heating time is 433 hours per year.**

## 6.2.2. Air conditioner programme in Singapore<sup>11</sup>

In 2014, the Government of Singapore introduced the Mandatory Energy Labelling (MELS) for regulated goods to help consumers compare the energy efficiency and make more informed purchasing decisions. Air conditioners are a major component of the scope of the MELS scheme. In addition to the mandatory labelling scheme, air conditioners are also subject to Minimum Energy Performance Standards (MEPS).

The details of active programs are summarized below:

**Table 20: Details of labelling program in Singapore**

<b>Label design</b>	 <p>Comparative label</p>
<b>Program type</b>	Mandatory
<b>Scope &amp; technical specifications</b>	Single-phase non-ducted room air-conditioner having a cooling capacity of: <ul style="list-style-type: none"> <li>• 8.8 kW or lower, for casement or window type air-conditioner;</li> <li>• 17.6 kW or lower, for split type (inverter) air-conditioner; or</li> <li>• 17.6 kW or lower, for split type (non-inverter) air-conditioner.</li> </ul>
<b>Residential/commercial</b>	<b>Residential</b>
<b>Active since</b>	2014
<b>Implementing body</b>	National Environment Agency (NEA)
<b>Key stakeholders</b>	Singapore Accreditation Council (SAC) for accrediting test laboratories
<b>Parameters graded</b> <b>Label Band range</b>	Energy Efficiency 1 Tick (lowest) to 5 Ticks (highest)
<b>Parameters displayed on the label</b>	<ul style="list-style-type: none"> <li>• Annual Energy Cost<sup>12</sup></li> <li>• Annual energy consumption</li> <li>• Brand name, Model, Type, Size</li> <li>• Test Standards</li> <li>• Registration Number</li> </ul>
<b>Minimum qualification requirements</b>	Adherence to the MEPS requirements
<b>Test standard</b>	<ul style="list-style-type: none"> <li>• ISO 5151:2010 for Casement, window and single-split</li> </ul>

<sup>11</sup> Source: <http://www.nea.gov.sg/energy-waste/energy-efficiency/household-sector/the-energy-label>, retrieved on 5<sup>th</sup> March 2018

<sup>12</sup> Based on 27 cents per kWh electricity cost, 8 hours daily usage and 16 hours standby energy consumption

	<ul style="list-style-type: none"> <li>• ISO 15042:2011 for Multi-split</li> <li>• IEC 62301:2005 or IEC 62301:2011 for All (for standby power)</li> </ul>
<b>Tests prescribed</b>	<ul style="list-style-type: none"> <li>• Cooling capacity test</li> <li>• Standby power</li> </ul>

### Labelling bands

In order to help consumers better identify the more energy efficient models and spur suppliers to offer more efficient products, the energy rating system for air-conditioners, refrigerators and clothes dryers was revised on 1 September 2014.

The current tick rating is defined on the basis of **COP100% value, defined as “the ratio of total cooling capacity to effective power input at full load cooling capacity”**. For inverter type models, the model shall meet both the minimum COP100% and weighted COP<sup>13</sup>.

Table 21: Grading scheme for casement/window and fixed speed air conditioners

Rating	Casement or window (Up to 8.8 kW)	Single split (non-inverter)	Multi split (non-inverter)
	Value of COP (W/W)	Value of COP (W/W)	Value of COP (W/W)
<b>1 Tick</b>	2.90 ≤ COP100% < 3.78	-	-
<b>2 Ticks</b>	3.78 ≤ COP100% < 4.29	3.78 ≤ COP100% < 4.29	3.78 ≤ COP100% < 4.29
<b>3 Ticks</b>	4.29 ≤ COP100% < 4.86	4.29 ≤ COP100% < 4.86	4.29 ≤ COP100% < 4.86
<b>4 Ticks</b>	COP100% ≥ 4.86	COP100% ≥ 4.86	COP100% ≥ 4.86
<b>5 Ticks</b>	COP100% ≥ 5.50 Standby power ≤ 4 W	COP100% ≥ 5.50 Standby power ≤ 4 W	COP100% ≥ 5.50 Standby power ≤ 9 x N <sup>14</sup>

Table 22: Grading scheme for variable speed air conditioners

Rating	Single-split (inverter)	Multi-split (inverter)
	Value of COP (W/W)	Value of COP (W/W)
<b>1 Tick</b>	-	-
<b>2 Ticks</b>	Weighted COP ≥ 3.78 COP100% ≥ 3.34	Weighted COP ≥ 3.78 COP100% ≥ 3.34
<b>3 Ticks</b>	Weighted COP ≥ 4.29 COP100% ≥ 3.78	Weighted COP ≥ 4.29 COP100% ≥ 3.78
<b>4 Ticks</b>	Weighted COP ≥ 4.86 COP100% ≥ 4.29	Weighted COP ≥ 4.86 COP100% ≥ 4.29
<b>5 Ticks</b>	Weighted COP ≥ 5.50, COP100% ≥ 4.86 Standby power ≤ 4 W	Weighted COP ≥ 5.50, COP100% ≥ 4.86 Standby power ≤ 9 x N

<sup>13</sup> Weighted COP = 0.4 x COP100% + 0.6 x COP50%

<sup>14</sup> N = no. of indoor and outdoor units

## Existing MEPS levels for air conditioners

Table 23: Existing MEPS levels for air conditioners

Type of air conditioner	Minimum Coefficient of Performance (COP)
<b>Casement and window (Up to 8.8 kW)</b>	COP100% > 2.90
<b>Single-split (non-inverter)</b>	COP100% > 3.78
<b>Multi-split (non-inverter)</b>	COP100% > 3.78
<b>Single-split (inverter)</b>	Weighted COP > 3.78 and COP100% > 3.34
<b>Multi-split (inverter)</b>	Weighted COP2 > 3.78 and COP100% > 3.34

### 6.2.3. Air conditioner programme in Malaysia<sup>15</sup>

The Suruhanjaya Tenaga (Energy Commission) in Malaysia established its energy efficiency program for household appliances in 2013 to promote efficient use of energy in the country. Since then, the government has introduced Minimum Energy Performance Standards (MEPS) and a star rating comparative program for efficient material and appliances. Air conditioners are included in the scope of both programs. The program for air conditioners was revised in March 2018.

The star rating is determined by Cooling Seasonal Performance Factor (CSPF), which is defined as the ratio of total amount of heat the equipment can remove from indoor air when operated for cooling in active mode to the total annual amount of energy consumed by the equipment during the same period. **The unit is Wh/Wh.**

The details of active programs are summarized below:

Table 24: Details of labelling program in Malaysia for air conditioners

<p><b>Label design</b></p>	
<p><b>Program type</b></p>	<p>Comparative label</p> <p>Mandatory</p>

<sup>15</sup> Source: Official standard

<b>Scope</b>	single-phase non-ducted single split wall mounted type vapour compression air conditioners with cooling capacity up to 7.1 kW
<b>Implementing body</b>	Energy commission, Malaysia
<b>Parameters graded</b>	<ul style="list-style-type: none"> <li>Cooling Seasonal Performance Factor (CSPF)</li> </ul>
<b>Label Band range</b>	1 star (worst) to 5 star (best)
<b>Parameters displayed on the label</b>	<ul style="list-style-type: none"> <li>Average energy consumption per year</li> <li>Appliance type</li> <li>Brand and model</li> </ul>
<b>Minimum qualification requirements</b>	CSPF $\geq$ 3.10 Wh/Wh for all air conditioners with capacity upto 4.5 kW CSPF $\geq$ <b>2.90</b> Wh/Wh for all air conditioners with capacity between 4.5 & 7.1 kW
<b>Tests prescribed</b>	MS ISO 5151:2010 Test conditions defined in ISO 16538-1:2013

### Energy Efficiency grading

The energy efficiency grade for an air conditioning appliance is determined by calculation of its Cooling Seasonal Performance Factor (CSPF). The star rating is determined according to the following table.

*Table 25: Grading scheme for air conditioners*

Star rating	Tested CSPF (Wh/Wh)	
	Cooling capacity < 4.5kW	4.5kW < cooling capacity < 7.1kW
5 (best)	$\geq 5.30$	$\geq 5.10$
4	4.60 - 5.30	4.00 - 5.10
3	3.30 – 4.60	3.10 – 4.00
2	3.10 – 3.30	2.90 – 3.10
1 (worst)	< 3.10	< 2.90

The Cooling Seasonal Performance Factor (CSPF) is the ratio of total amount of heat the equipment can remove from indoor air when operated for cooling in active mode to the total annual amount of energy consumed by the equipment during the same period. The unit is Wh/Wh.

**The cooling capacity value shall be determined in accordance with the MS ISO 5151 and ISO 16358-1:2013.**

For non-inverter air conditioners, the CSPF is calculated as:

$$CSPF = 1.062 \times EER_{tested}$$

Where Energy Efficiency Ratio (EER) is defined as ratio of total cooling capacity to effective power input at full load. For inverter air conditioners, CSPF is calculated using the measured energy consumption during the tests.

### Major brands

The major brands of ACs available in Malaysia include Hitachi, LG, Panasonic, Midea, Hisense etc.

## 6.2.4. Air conditioner programme in Thailand

In order to improve the overall level of energy efficiency in the appliance sector in Thailand, the country's government enacted the ECP Act in 1992, which provided the relevant authorities such as Department of Alternative Energy Development and Efficiency (DEDE) the power to implement standards and labelling programs for appliances.



Subsequently, a voluntary labelling programme - the Energy Efficiency Labelling No. 5 Programme was **established in 1993** with the objective to inform consumers that No. 5 labeled appliances/equipment are highly energy efficient and hence will reduce their electricity bills.

In 2004, the Thai Industrial Standard Institute (TISI), declared the Minimum Energy Performance Standard (MEPS) for the air conditioners of size 8,000 and 12,000 watt. In 2005, the requirements for models for achieving the EGAT label no.5 criteria were subsequently strengthened.

In addition, a voluntary label – the Green label – was made available to high performing air conditioner models in Thailand in 2008. The Green Labelling criteria applies to room air conditioner used with air-cooled condenser or evaporative condenser in order to decrease temperature and humidity only. However, the air conditioner must have a net total cooling capacity not exceeding 12,000 W operating on either single-phase or three-phase AC circuits of frequency 50 Hz.

The details of active programs are summarized below:

*Table 26: Details of labelling programs in Thailand for air conditioners*

<b>Label design</b>		
	Comparative label	Endorsement label
<b>Program type</b>	Voluntary	Voluntary
<b>Scope &amp; technical specifications</b>	All types of air conditioners with a <b>net cooling capacity upto 12 kW</b>	
<b>Active since</b>	1993, Amended 2015	2008
<b>Implementing body</b>	EGAT & DEDE	
<b>Key stakeholders</b>	Department of Alternative Energy Development and Efficiency (DEDE) responsible for setting high efficiency labels Standards are set up by DEDE, and labelling programs are responsible by DEDE and EGAT	



	EGAT performs market surveillance and check testing of labelled appliances	
<b>Parameters graded Label Band range</b>	Energy Efficiency Ratio (EER) for fixed speed air conditioners Seasonal Energy Efficiency Ratio (SEER) for variable speed air conditioners	-
	No. 5 (best) to No. 3 (worst)	
<b>Parameters displayed on the label</b>	<ul style="list-style-type: none"> <li>AC type – fixed speed/ inverter type</li> <li>EER/SEER</li> <li>General details</li> </ul>	-
<b>Minimum qualification requirements</b>	Minimum EER as per No. 3 of EGAT label	<ul style="list-style-type: none"> <li>Qualify for No. 5 of the EGAT label</li> <li>Adhere to sound requirements</li> <li>Adhere to ODP &amp; GWP requirements</li> <li>Qualify for safety requirements as per TIS 15294 or IEC 60335-2-405 or equivalent</li> </ul>
<b>Tests prescribed</b>	<ul style="list-style-type: none"> <li>Energy Efficiency Ratio (EER) as per ISO 5151:2010</li> <li>Seasonal Energy Efficiency Ratio (SEER) as per ISO 16358-1: 2013</li> </ul>	<ul style="list-style-type: none"> <li>ODP &amp; GWP</li> <li>Other certifications regarding manufacturing etc.</li> <li>Sound</li> </ul>

### Labelling bands for fixed speed air conditioners as per the EGAT label<sup>16</sup>

Table 27: Grading scheme for air conditioners as per the EGAT label

Efficiency	Capacity ≤ 8 kW, 27296 BTU/Hr.	Capacity > 8000 Watt, 27296 BTU/Hr.
	Value of EER (W/W)	Value of EER (W/W)
<b>No. 5</b>	11.60 ≤ EER	11.00 ≤ EER
<b>No. 4</b>	11.00 ≤ EER < 11.60	10.60 ≤ EER < 11.00
<b>No. 3</b>	10.60 ≤ EER < 11.00	9.60 ≤ EER < 10.60

**Energy Efficiency Ratio: EER** refers to ratio of net total cooling capacity to electrical power input to air conditioner.

### Other requirements to qualify for the Green Label

- Sound pressure level of an air conditioner shall comply with the following requirements:

Table 28: Sound pressure requirements

Type of air conditioner, Cooling Capacity	Sound pressure level (dB)	
	Indoors	Outdoors
Single pack	≤ 55	≤ 60
Split, ≤8 kW	≤ 50	≤ 57
Split, >8 kW to 12 kW	≤ 57	≤ 63

<sup>16</sup> Source: <https://www.iea.org/policiesandmeasures/pams/thailand/name-155766-en.php>, retrieved on 14 February 2018

*A copy of sound pressure level test report using test method according to JIS C 9612 or equivalent standard must be submitted by the applicant.*

- Ozone depleting potential (ODP) of Refrigerant shall not exceed 0.5 and Global warming potential (GWP100a) shall not exceed 2500

**Ozone Depleting Potential: ODP** refers to potential of a substance to destroy ozone in comparison with the potential of CFC 11.

**Global Warming Potential:** GWP refers to potential of a greenhouse gas to contribute global warming, which depends on infrared radiative forcing and atmospheric lifetime of the gas, in comparison with infrared radiative forcing of carbon dioxide over a 100 year period<sup>2</sup>

- Product shall be designed to promote recycling, which by means of supplying recyclable plastic components at least 80% by weight of plastic components in product
- **Energy efficiency of product shall comply with EGAT Label No.5. (Updated edition on application date for Green Label certification)**
- Each plastic component of an air conditioner which weighs more than 25g shall contain heavy metals or their compounds and flame retardants, additional requirements are present in the document.

### **Prescribed test standards**

To qualify for the EGAT label no. 5, an air conditioner model must follow the test procedures mentioned either in TIS 2710-2558 or in ISO 5151: 2010.

For fixed speed air conditioners, the prescribed test standard for calculation of energy efficiency is TIS 1155-2557 or TIS 2134-2553, depending on the air conditioner type. For variable speed air conditioners, TIS 2714 Class 1 - 2558 or ISO 16358-1: 2013 are prescribed to calculate seasonal energy performance.

### **To qualify for the Green label, additional requirements include:**

- Certification to Thai Industrial Standards for Room air conditioners: Energy efficiency, TIS 21343 and TIS 385 or Thai Industrial Standards for Air-cooled split type room air conditioners, TIS 1155.
- Certification to Thai Industrial Standard or pass the product safety tests according to TIS 15294 or IEC 60335-2-405 or equivalent standard

## 6.2.5. Air conditioner programme in India

The standards & labelling scheme in India was launched in 2006 and applies to a range of residential and industrial equipment/appliances. The labelling scheme is mandatory for air conditioners in India.

S&L specifies the energy labelling requirements for single-phase split and unitary air conditioners of the vapour compression type for household use up to a rated cooling capacity of 11 kW.

In addition, MEPS for unitary type air-conditioners were set to an Energy Efficiency Ratio (W/W) star rating band of 2.30 to 2.49 in the year 2012 and 2013 which was subsequently revised to 2.50 to 2.69 in the year 2014 and 2015. Similarly, for split type air-conditioners the EER star rating band for the year 2012 and 2013 was 2.50 to 2.69 which was subsequently revised to 2.70 to 2.89 in the years 2014 and 2015.

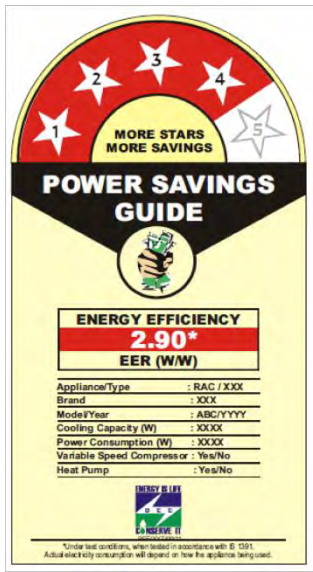
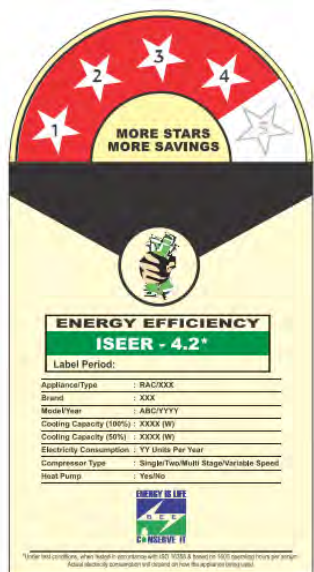
### Air conditioner market in India<sup>17</sup>

The most commonly sold air conditioners in India are window ACs and split-unit ACs. They are available in the capacity range of 0.75 to 3 ton of refrigeration (TR) (2.63 kW to 10.55 kW). The 0.75 to 1 ton units constitute the 'small' category, 1 to 2 ton units the 'medium' category, and units above 2 tons fall under the 'large' category. The 1.5 TR capacity has been identified as the most selling model in the room air conditioners market.

Fixed speed air conditioner types are the most common in India. However, in recent times, Inverter-type air conditioners have entered the Indian market. However, this technology is currently mostly available only in split air conditioners.

The details of active programs are summarized next:

Table 29: Details of labelling programs in India for air conditioners

<p><b>Label design</b></p>		
<p><b>Program type</b></p>	<p>Mandatory comparative</p>	<p>Mandatory comparative</p>
<p><b>Scope &amp; technical specifications</b></p>	<p>Single-phase split and unitary air conditioners of the vapour compression type for household use</p>	<p>Single phase upto &amp; including 250V AC variable capacity air conditioners of the vapour compression type</p>

<sup>17</sup> Source: <http://www.bigeer.net/en/country/in/appliances/#appliance13>, retrieved on 16 February 2018

	up to a rated cooling capacity of 11 kW	including a rated cooling capacity of 9000 kCal/h.
<b>Residential/commercial</b>	Residential	
<b>Active since</b>	2006	2013
<b>Implementing body</b>	Bureau of Energy Efficiency (BEE)	
<b>Key stakeholders</b>	IAME (Independent Agency for Monitoring and Enforcement)	
<b>Parameters graded Label Band range</b>	Energy Efficiency Ratio (EER)	Indian Seasonal Energy Efficiency Ratio (ISEER)
	1 star (lowest) to 5 star (highest)	
<b>Parameters displayed on the label</b>	<ul style="list-style-type: none"> <li>• Energy efficiency ratio (EER)</li> <li>• Appliance type</li> <li>• Model number</li> <li>• Cooling capacity</li> <li>• Power consumption</li> </ul>	
<b>Minimum qualification requirements</b>	As per MEPS requirement	
<b>Test standard</b>	IS 1391 Part 1 and Part 2	ISO 16358-1: 2013
<b>Tests prescribed</b>	<ul style="list-style-type: none"> <li>• Energy consumption</li> <li>• Cooling capacity</li> </ul>	<ul style="list-style-type: none"> <li>• Energy consumption</li> <li>• Cooling capacity</li> </ul>

### Star rating bands for fixed speed air conditioners

The energy efficiency star rating for a model of a fixed speed AC is determined on the basis of its Energy Efficiency Ratio (EER). The grading bands are shown below:

*Table 30: Grading scheme for fixed speed air conditioners*

Star rating	Range of EER (W/W)	
	Unitary type	Split type
1 star	2.5 – 2.69	2.70 – 2.89
2 star	2.70 – 2.89	2.90 – 3.09
3 star	2.90 – 3.09	3.10 – 3.29
4 star	3.10 – 3.29	3.30 – 3.49
5 star	≥ 3.30	≥ 3.50

## Star rating bands for inverter ACs

Table 31: Grading scheme for variable speed air conditioners

Star rating	Range of ISEER (Wh/Wh)	
	Minimum	Maximum
1 star	3.10	3.29
2 star	3.30	3.49
3 star	3.5	3.99
4 star	4.00	4.49
5 star	4.50	-

The key terminologies used are:


- Cooling Seasonal Energy Consumption (CSEC) – Total annual amount of energy consumed by the equipment when it is operated for cooling in active mode.
- Cooling Seasonal Total Load (CSTL) – Total annual amount of heat that is removed from the indoor air when the equipment is operated for cooling in active mode.
- Indian Seasonal Energy Efficiency Ratio (ISEER) – Ratio of the total annual amount of heat that the equipment can remove from the indoor air when operated for cooling in active mode to the total annual amount of energy consumed by the equipment during the same period.

## 6.2.6. Air conditioner programme in Hong Kong<sup>18</sup>

The Government of Hong Kong, in 2008, introduced MEELS through the Energy Efficiency (Labelling of Products) Ordinance in order to generate public awareness and promote the use of energy efficient appliances. Under MEELS, it is mandatory to show an energy label for prescribed products for supply in Hong Kong.

Also, the labelling standards are regularly updated to keep up with advancement in technology and current status of market for energy efficiency in Hong Kong. The details of active programs are summarized below:

Table 32: Details of labelling program in Hong Kong for air conditioners

Label design	Comparative label
	

<sup>18</sup> Source: 12. “Code of Practice on Energy Labelling of Products”, Hong Kong, 2014

<b>Program type</b>	Mandatory
<b>Scope &amp; technical specifications</b>	All room air conditioners <b>having a rated cooling capacity upto 7.5 kW</b>
<b>Residential/commercial</b>	<b>Residential</b>
<b>Active since</b>	2008
<b>Implementing body</b>	The Director, Electrical and Mechanical Services
<b>Parameters graded</b>	Energy Efficiency
<b>Label Band range</b>	Grade 1 (Best) to Grade 5 (Worst)
<b>Parameters displayed on the label</b>	<ul style="list-style-type: none"> <li>• Annual energy consumption (kWh/year)</li> <li>• Cooling capacity (kW)</li> <li>• Refrigerant used</li> <li>• Model number, brand details etc.</li> </ul>
<b>Minimum qualification requirements</b>	Adherence to the MEPS requirements
<b>Test standard</b>	<ul style="list-style-type: none"> <li>• ISO 5151:2010</li> </ul>
<b>Tests prescribed</b>	<ul style="list-style-type: none"> <li>• Maximum cooling performance test</li> </ul>

### Determination of energy efficiency grading

The energy efficiency grade of the room air conditioner is determined through the value of the AC's Cooling Seasonal Performance Factor (CSPF). Grade 1 is provided for the best performance and Grade 5 for the worst.

Table 33: Grading scheme for air conditioners

Energy efficiency grade	Cooling Seasonal Performance Factor (CSPF)	
	Single Package	Split type
Grade 1	$3.00 \leq \text{CSPF}$	$4.50 \leq \text{CSPF}$
Grade 2	$2.80 \leq \text{CSPF} < 3.00$	$3.50 \leq \text{CSPF} < 4.50$
Grade 3	$2.60 \leq \text{CSPF} < 2.80$	$3.15 \leq \text{CSPF} < 3.50$
Grade 4	$2.40 \leq \text{CSPF} < 2.60$	$2.80 \leq \text{CSPF} < 3.15$
Grade 5	$\text{CSPF} < 2.40$	$\text{CSPF} < 2.80$

In order to obtain Grade 1 to 4, the room air conditioner concerned must also pass the maximum cooling performance test. Otherwise, the model will only be eligible for Grade 5.

### Calculation of Cooling Seasonal Performance Factor (CSPF)

The cooling seasonal performance factor (CSPF),  $F_{CSP}$ , of the room air conditioner is calculated as follows:

$$F_{CSP} = \frac{L_{CST}}{C_{CSE}}$$

Where,  $L_{CST}$  is the cooling seasonal total load to be calculated in accordance with ISO 16358-1

$C_{CSE}$  is the cooling seasonal energy consumption to be calculated in accordance with ISO 16358-1

The defined cooling load and the outdoor temperature bin distribution is as shown below:

**Table 34: Defined cooling load**

Defined cooling load		
Parameter	Load zero (o)	Load 100%
Cooling load (W)	0	$\phi_{ful}(t_{100})$
Outdoor Temperature (°C)	$t_0 = 23^{\circ}\text{C}$	$t_{100} = 35^{\circ}\text{C}$
<i>where <math>\phi_{ful}(t_{100})</math> is the cooling capacity at <math>t_{100}</math> at full load operation condition  <math>t_{100}</math> is the outdoor temperature at 100 % load and <math>t_0</math> is the outdoor temperature at 0 % load.</i>		

**Table 35: Outdoor temperature bin distribution**

Outdoor temperature bin distribution														
Bin no. <i>j</i>	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
Outdoor temperature (°C)	24	25	26	27	28	29	30	31	32	33	34	35	36	-
Bin hours (hour)	67	117	147	177	210	183	114	75	56	33	15	5	1	1200

### Other requirements

**Table 36: Other requirements**

Parameter	Requirement
The measured cooling capacity from full capacity test at standard cooling condition (T1 climate)	Minimum 95%
The measured power consumption from full capacity test at standard cooling condition (T1 climate)	Not greater than 110%
Cooling Seasonal Performance Factor	Minimum 90% of rated cooling seasonal performance factor
maximum cooling performance test	Must pass

In addition to the energy efficiency performance requirements, all room air conditioners shall comply with the Electrical Products (Safety) Regulation, Chapter 406G of the Laws of Hong Kong, and the safety standards specified under the Regulation, and all other legislations concerning the safety of the room air conditioners.

## 6.3. Refrigerators

### 6.3.1. Refrigerator programme in China<sup>19</sup>

The government of China's first energy efficiency program for refrigerators began in 1989, when CNIS (China National Institute of Standardization) issued first set of MEES (Minimum Energy Efficiency Standards) for refrigerators.

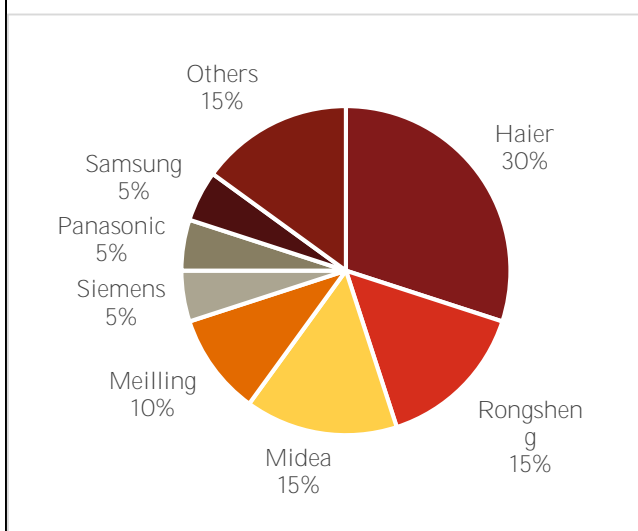
In 2004, China's National Development and Reform Commission (NDRC) and the Administration of Quality Supervision, Inspection and Quarantine of China (AQSIQ) released the "Measures management of the energy label", which initiated the introduction of a mandatory energy-labelling programme in China. Under the mandatory energy labelling program, a comparative label was designated to the refrigerators, which used a categorical system from Grade 1 (best) to Grade 5 (worst).

The MEES levels were amended in 2008, and were renamed as MEPS (Minimum Energy Performance Standards) levels. They were set as Grade 2 in 2008, and were further upgraded in 2013 as Grade 3 for refrigerators.

There also exists a voluntary labelling programme, introduced in 2008, under which an endorsement label is awarded only to Grade 1 and Grade 2 refrigerators.

#### Refrigerator market in China<sup>20</sup>

The Household Refrigerator and Freezer Manufacturing industry accounts for about 16.0% of the total Household Electrical Appliance Manufacturing subsector in China. This share increased steadily in the years leading up to 2000, but it has remained relatively stable since. Demand for industry products increased steadily in 2010 and 2011.



However, growth began to slow in 2012, mainly due to the economic downturn in China. Over the five years through 2017, industry revenue has been growing at an annualized rate of 8.8% to \$70.0 billion.

Key brands in the refrigerator market in China (2011) are shown in the pie chart. **Haier had the maximum share of the market that year at 30%.<sup>21</sup>**

There are both locally manufactured refrigerators and big brands that are manufactured in China. China is the largest exporter of refrigerators in the world. Most common refrigerator used is double door 200L-500L (75 %).

**HCFC R-22 is the most common type of refrigerant used.**

<sup>19</sup> Source: Wuppertal Institute for Climate, Environment and Energy, 2014



<sup>20</sup> Source: IBIS World research, 2017

<sup>21</sup> Source: <https://www.businesswire.com/news/home/20120920006790/en/CCID-Consulting-China%E2%80%99s-Home-Appliances-Market-Status>, as retrieved on 25th February, 2018.



The details of active programs are summarized below:

*Table 37: Details of labelling programs for refrigerators in China*

<b>Label design</b>		
	Comparative label	Endorsement label
<b>Program type</b>	Mandatory	Voluntary
<b>Scope &amp; technical specifications</b>	<p>Mandatory energy labelling for refrigerating appliances intended for household and similar use, being manufactured or imported, coming under the following categories:</p> <ul style="list-style-type: none"> <li>• 15l refrigerator compartment temperature change between volume and higher temperature zone and having ice function.</li> <li>• 100l refrigerator volume or less.</li> <li>• With a volume greater than 400l Refrigerator automatic ice-penetrating function.</li> <li>• Adjusted volume of greater than 500l</li> <li>• Both conventional and inverter type of refrigerators.</li> </ul> <p>Defined for residential refrigerators. Classified into:</p> <ul style="list-style-type: none"> <li>• All refrigerator (Type 1)</li> <li>• Refrigerator with 1* compartment (Type 2)</li> <li>• Refrigerator with 2* compartment (Type 3)</li> <li>• Refrigerator with 3* compartment (Type 4)</li> <li>• Refrigerator-freezer (2 door with automatic defrost) (Type 5)</li> </ul>	
<b>Active since</b>	1999	2008
<b>Implementing body</b>	China Energy Label Center (CNIS)	
<b>Key stakeholders</b>	<ul style="list-style-type: none"> <li>• Industry Associations</li> <li>• Test Labs</li> <li>• CLASP</li> <li>• CNIS</li> <li>• AQSIO</li> <li>• CNCA</li> <li>• NDRC</li> <li>• Manufacturers (Haier, Rongsheng etc.)</li> </ul>	
<b>Parameters graded</b>	Annual Energy (E) (kWh/year)	Not applicable

<b>Label Band range</b>	Tier 5 (worst) to Tier 1 (best)	
<b>Parameters displayed on the label</b>	<ul style="list-style-type: none"> <li>• Product Manufacturer</li> <li>• Product Model Number</li> <li>• Level</li> <li>• Energy Consumption</li> <li>• Energy Efficiency</li> <li>• Off Energy Consumption (in Watts)</li> <li>• Energy Efficiency</li> </ul>	Not applicable
<b>Minimum qualification requirements</b>	<ul style="list-style-type: none"> <li>• Minimum threshold of MEPS is Grade 3.</li> <li>• Manufacturing and testing tolerance as prescribed by the CNIS</li> </ul>	Qualify for Grade 2 of the comparative label
<b>Tests prescribed</b>	<ul style="list-style-type: none"> <li>• ISO15502 test procedure (or IEC 62552 edition 1).</li> <li>• Energy efficiency test at ISO Tropical temperature of <b>32°C</b>.</li> <li>• Freezer test package required.</li> </ul>	

### Labelling scheme for refrigerators:

The rating of a refrigerator is determined as an Energy Efficiency Factor using the adjusted volume. The applicable equations are as follows:

- Type 1:  $E_{ref} = 233 + 0.221 \times AV$
- Type 2:  $E_{ref} = 181 + 0.611 \times AV$
- Type 3:  $E_{ref} = 233 + 0.428 \times AV$
- Type 4:  $E_{ref} = 233 + 0.624 \times AV$
- Type 5:  $E_{ref} = 272 + 0.697 \times AV$

#### The types of refrigerators are defined as follows:

- All refrigerators with no freezer compartment (Type 1)
- Refrigerator with 1\* freezer compartment (Type 2)
- Refrigerator with 2\* freezer compartment (Type 3)
- Refrigerator with 3\* freezer compartment (Type 4)
- Refrigerator-freezer (2 door with automatic defrost) (Type 5)

The freezer compartments are described as follows:<sup>22</sup>

Type	Description
Refrigerator with 1-star freezer compartment	<b>Minimum temperature = -6 °C (21 °F)</b> . Maximum storage time for (pre-frozen) food is 1 week.
Refrigerator with 2-star freezer compartment	<b>Minimum temperature = -12 °C (10 °F)</b> . Maximum storage time for (pre-frozen) food is 1 month.
Refrigerator with 3-star freezer compartment	<b>Minimum temperature = -18 °C (0 °F)</b> . Maximum storage time for (pre-frozen) food is between 3 and 12 months depending on type (meat, vegetables, fish, etc.)
Refrigerator with 4-star freezer compartment	<b>Minimum temperature = -18 °C (0 °F)</b> . Maximum storage time for pre-frozen or frozen-from-fresh food is between 3 and 12 months

The adjusted volume, AV is calculated as follows:

<sup>22</sup> Source: bbc.co.uk, skillwise, Star Ratings, 2011.

$$AV = (V_f \times K) + V_r$$

Where AV is adjusted volume, in cubic decimeters,  $V_f$  is frozen food storage compartment volume, in cubic decimeters,  $V_r$  is fresh food storage compartment volume, in cubic decimeters, and K is constant factor, calculated by the formula as follows:

$$K = (32 - t_f) / (32 - t_m)$$

Where  $t_f$  is frozen food storage compartment temperature, in degrees Celsius, and  $t_m$  is fresh food storage compartment temperature, in degrees Celsius.

The energy efficiency index (EEI) is calculated as follows:

$$EEI = E_{\text{measured}} / E_{\text{ref}}$$

$E_{\text{measured}}$  is the measured annual energy consumption for that particular type of refrigerator in kWh.

The rating is allocated as follows<sup>23</sup>:

**Table 38: Grading scheme for refrigerators in China**

Rating	Refrigerator Freezer (Type 5)	Other Types
<b>5 (Worst)</b>	0.7 < EEI ≤ 0.8	0.8 < EEI ≤ 0.9
<b>4</b>	0.6 < EEI ≤ 0.7	0.7 < EEI ≤ 0.8
<b>3</b>	0.5 < EEI ≤ 0.6	0.6 < EEI ≤ 0.7
<b>2</b>	0.4 < EEI ≤ 0.5	0.5 < EEI ≤ 0.6
<b>1 (Best)</b>	EEI ≤ 0.4	EEI ≤ 0.5

### **6.3.2. Refrigerator programme in Singapore<sup>24</sup>**

The Government of Singapore introduced the Mandatory Energy Labelling Scheme (MELS) in 2014 for regulated goods to help consumers compare the energy efficiency and make more informed purchasing decisions. Under MELS, the refrigerators were subjected to a comparative label, which uses a tick rating system, ranging from 1 tick (worst) to 5 ticks (best)

Under the mandatory labelling scheme, the refrigerators are also subjected to Minimum Energy Performance Standards (MEPS) for increasing the energy efficiency of the refrigerators, which was set as 2 ticks in 2014, and was revised to 3 ticks in 2017.

The National Environmental Agency (NEA) is responsible for implementation of the MELS.

<sup>23</sup> Source: Wuppertal Institute for Climate, Environment and Energy, 2014.

<sup>24</sup> Source: <http://www.nea.gov.sg/energy-waste/energy-efficiency/household-sector/the-energy-label> as retrieved on 5th March, 2018.


### Refrigerator market in Singapore:

The Singaporean market for refrigerators is primarily divided into three categories:

- **Refrigerator only**
- **Refrigerator freezer**
- **Refrigerator-freezer with through the door ice and water (TTD) dispenser:** These refrigerators are marked by the following features:
  - ✓ They have an in-built through the door dispenser which can be used to dispense either ice or water as and when required.
  - ✓ They also contain the freezer chamber, in addition to the refrigeration chamber.

There are both locally manufactured refrigerators and big brands that are manufactured in Singapore. Singapore is a net exporter of refrigerators. Most common refrigerator used is double door 300l-600l.

Table 39: Details of labelling program for refrigerators in Singapore

<b>Label Design</b>	Comparative labelling  
<b>Program Type</b>	Mandatory
<b>Scope &amp; Technical Specifications</b>	Mandatory energy labelling for refrigerating appliances intended for household and similar use, being manufactured or imported, coming under the following categories: <ul style="list-style-type: none"> <li>• All household refrigerators with an adjusted volume up to 900l.</li> <li>• Conventional or Inverter type refrigerators.</li> </ul> HCFC R-22 and HCFC R-141b are the major refrigerants used in Singapore.
<b>Categories specified</b>	broad categories are specified for energy labelling: <ul style="list-style-type: none"> <li>• Refrigerator without freezer.</li> <li>• Refrigerator with freezer (V<sub>adj</sub> tot ≤ 300 litres)</li> <li>• Refrigerator with freezer (V<sub>adj</sub> tot &gt; 300 and ≤ 900 litres)</li> <li>• Refrigerator with freezer, through-the-door ice dispenser</li> </ul>
<b>Active Since</b>	2014
<b>Implementing body</b>	National Environmental Agency (NEA)
<b>Key Stakeholders</b>	<ul style="list-style-type: none"> <li>• Industry Associations</li> <li>• Singapore Accreditation Council (SAC) for accrediting test laboratories</li> <li>• National Environmental Agency (NEA)</li> <li>• International Electrotechnical Commission (IEC)</li> <li>• International Organization for Standardization (ISO)</li> </ul>

	<ul style="list-style-type: none"> <li>Manufacturers (Hitachi, Mitsubishi, LG, Samsung, Whirlpool etc.)</li> </ul>
<b>Parameters Graded</b>	Annual Energy Consumption (AEC) (kWh/year)
<b>Label Brand Range</b>	1 tick (worst) to 5 ticks (best)
<b>Parameters displayed on the label</b>	<ul style="list-style-type: none"> <li>Energy efficiency rating</li> <li>Ticks</li> <li>Annual energy cost</li> <li>Annual energy consumption</li> <li>Brand Name</li> <li>Model Number</li> <li>Type of Refrigerator</li> <li>Total Storage Volume (L)</li> <li>Test Standard</li> <li>Disclaimer</li> <li>Registration Number</li> </ul>
<b>Minimum Qualification Requirements</b>	As per the implementation of MEPS, 3 tick marks is the minimum qualification requirement.
<b>Tests Prescribed</b>	<ul style="list-style-type: none"> <li>ISO15502 test procedure (or IEC 62552 edition 1).</li> <li><b>Energy efficiency test at ISO Tropical temperature of 32°C.</b></li> <li>Freezer test package required.</li> </ul>

### Energy labelling for refrigerators:

The MEPS of a refrigerator is determined as an annual energy consumption (AEC in kWh) using the adjusted volume.

The adjusted volume is calculated as follows:

$$V_{adj} = \Sigma(K_c * \text{Actual volume of the compartment})$$

$K_c$  is the volume correction factor for a particular type of compartment and is defined as follows:

*Table 40: Volume correction factors*

Compartment Type	Volume Correction Factor ( $K_c$ )
Fresh Food	1.00
4 star freezer	1.79
3 star freezer	1.79
2 star freezer	1.57
1 star freezer	1.36
Chill	1.13
Cellar	0.75

The tick mark levels are defined as follows:<sup>25</sup>

<sup>25</sup> Source: <http://www.nea.gov.sg> as retrieved on 5<sup>th</sup> March, 2018.

Table 41: Grading scheme for refrigerators

Type	Annual Energy Consumption (AEC) in kwh/ year			
	1 Tick	2 Ticks	3 Ticks	4 Ticks
Without freezer	$[(368 + 0.892 \times \text{Vadj tot}) \times 0.551] \geq \text{AEC} > [(368 + 0.892 \times \text{Vadj tot}) \times 0.461]$	$[(368 + 0.892 \times \text{Vadj tot}) \times 0.461] \geq \text{AEC} > [(368 + 0.892 \times \text{Vadj tot}) \times 0.332]$	$[(368 + 0.892 \times \text{Vadj tot}) \times 0.332] \geq \text{AEC} > [(368 + 0.892 \times \text{Vadj tot}) \times 0.239]$	$[(368 + 0.892 \times \text{Vadj tot}) \times 0.239] \geq \text{AEC}$
With freezer (Vadj tot $\leq$ 300 litres)	$[(465 + 1.378 \times \text{Vadj tot}) \times 0.553] \geq \text{AEC} > [(465 + 1.378 \times \text{Vadj tot}) \times 0.427]$	$[(465 + 1.378 \times \text{Vadj tot}) \times 0.427] \geq \text{AEC} > [(465 + 1.378 \times \text{Vadj tot}) \times 0.312]$	$[(465 + 1.378 \times \text{Vadj tot}) \times 0.312] \geq \text{AEC} > [(465 + 1.378 \times \text{Vadj tot}) \times 0.228]$	$[(465 + 1.378 \times \text{Vadj tot}) \times 0.228] \geq \text{AEC}$
With freezer (Vadj tot $>$ 300 and $\leq$ 900 litres)	$[(465 + 1.378 \times \text{Vadj tot}) \times 0.506] \geq \text{AEC} > [(465 + 1.378 \times \text{Vadj tot}) \times 0.427]$	$[(465 + 1.378 \times \text{Vadj tot}) \times 0.427] \geq \text{AEC} > [(465 + 1.378 \times \text{Vadj tot}) \times 0.312]$	$[(465 + 1.378 \times \text{Vadj tot}) \times 0.312] \geq \text{AEC} > [(465 + 1.378 \times \text{Vadj tot}) \times 0.228]$	$[(465 + 1.378 \times \text{Vadj tot}) \times 0.228] \geq \text{AEC}$
With freezer, through-the-door ice dispenser	$[(585 + 1.378 \times \text{Vadj tot}) \times 0.485] \geq \text{AEC} > [(585 + 1.378 \times \text{Vadj tot}) \times 0.409]$	$[(585 + 1.378 \times \text{Vadj tot}) \times 0.409] \geq \text{AEC} > [(585 + 1.378 \times \text{Vadj tot}) \times 0.298]$	$[(585 + 1.378 \times \text{Vadj tot}) \times 0.298] \geq \text{AEC} > [(585 + 1.378 \times \text{Vadj tot}) \times 0.218]$	$[(585 + 1.378 \times \text{Vadj tot}) \times 0.218] \geq \text{AEC}$

The MEPS levels are calculated as follows:

Table 42 MEPS levels for refrigerators in Singapore

Type	Annual Energy Consumption (AEC) in kwh
	MEPS level
Without freezer	$[(368 + 0.892 \times \text{Vadj tot}) \times 0.332] \geq \text{AEC} > [(368 + 0.892 \times \text{Vadj tot}) \times 0.239]$
With freezer (Vadj tot $\leq$ 300 litres)	$[(465 + 1.378 \times \text{Vadj tot}) \times 0.312] \geq \text{AEC} > [(465 + 1.378 \times \text{Vadj tot}) \times 0.228]$
With freezer (Vadj tot $>$ 300 and $\leq$ 900 litres)	$[(465 + 1.378 \times \text{Vadj tot}) \times 0.312] \geq \text{AEC} > [(465 + 1.378 \times \text{Vadj tot}) \times 0.228]$
With freezer, through-the-door ice dispenser	$[(585 + 1.378 \times \text{Vadj tot}) \times 0.298] \geq \text{AEC} > [(585 + 1.378 \times \text{Vadj tot}) \times 0.218]$

### 6.3.3. Refrigerator programme in Malaysia<sup>26</sup>

Malaysia introduced a mandatory comparative labelling program for household refrigerators in 2004. The label uses a star rating approach with 1 star indicating the lowest efficiency and 5 stars the highest efficiency. Subsequently in 2013, MEPS for household refrigerators were introduced, which was set at 1 star. The MEPS value was further revised to two stars in 2014.

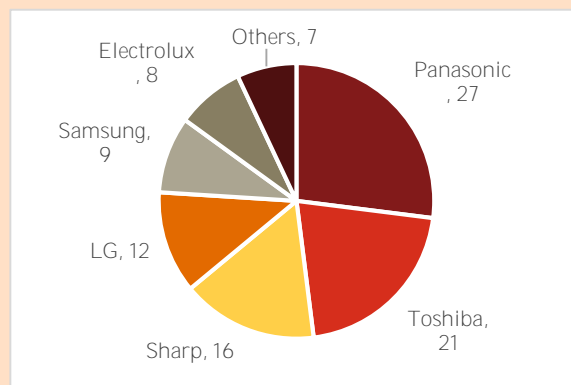
There also exists a voluntary label scheme for refrigerators, under which an endorsement label is given to the refrigerators which have the highest efficiency (5 stars).

#### Refrigerator market in Malaysia<sup>27</sup>:

The Malaysian market for refrigerators is primarily divided into two categories:

1. One door refrigerator
2. Two door refrigerator

Panasonic, Toshiba and Sharp constitute more than 50% of the market in Malaysia. The breakup between major players in the market is shown in the pie chart.



There are both locally manufactured refrigerators and big brands that are manufactured in Malaysia. Malaysia is a net importer of refrigerators, majorly from China and Thailand. Most common refrigerator used is double door 200 L to 500L.

**HCFC R-22 and HCFC R-141b are the most common refrigerants used.**

The details of active programs are summarized below:

Table 43: Details of labelling programs for refrigerators in Malaysia

Label design		
	Comparative label	Endorsement label

<sup>26</sup> Source: <http://www.st.gov.my> as retrieved on 27<sup>th</sup> February 2018.

<sup>27</sup> Source: REVIEW OF REFRIGERATOR ENERGY EFFICIENCY THRESHOLDS IN SELECTED ASIAN COUNTRIES, Energy Efficient strategies for the Australian Government, Final Report, Australia, April 2014.

<b>Program type</b>	Mandatory	Voluntary
<b>Scope &amp; technical specifications</b>	Mandatory energy labelling for refrigerating appliances intended for household and similar use, being manufactured or imported, coming under the following categories: <ul style="list-style-type: none"> <li>• All household refrigerators with an adjusted volume up to 800l.</li> <li>• Conventional or Inverter type refrigerators.</li> <li>• Single or double door refrigerators</li> </ul>	
<b>Active since</b>	2004	
<b>Implementing body</b>	Energy Commission	
<b>Key stakeholders</b>	<ul style="list-style-type: none"> <li>• Industry Associations</li> <li>• Test Labs</li> <li>• Energy Commission</li> <li>• Standard and Industrial Research Institute of Malaysia (SIRIM)</li> <li>• International Electrotechnical Commission (IEC)</li> <li>• International Organization for Standardization (ISO)</li> <li>• Manufacturers (Panasonic, Toshiba, Sharp etc.)</li> </ul>	
<b>Parameters graded Label Band range</b>	Energy Efficiency Factor (EEF) ratio (Litres/kWh/day)	-
	1 star (worst) to 5 stars (best)	
<b>Parameters displayed on the label</b>	<ul style="list-style-type: none"> <li>• Energy rating in stars</li> <li>• Appliance Type</li> <li>• Appliance Energy Rating</li> <li>• Brand and model information</li> <li>• Energy Consumption</li> <li>• Energy savings compared to lowest 2 star rated product</li> <li>• Testing standards used at lab conditions</li> </ul>	<ul style="list-style-type: none"> <li>• Energy rating in stars</li> <li>• Appliance Energy Rating</li> </ul>
<b>Minimum qualification requirements</b>	As per the implementation of MEPS in 2014, 2 star is the minimum energy rating under the mandatory labelling programme.	Voluntary labelling programme includes only the refrigerators for 5 star energy rating.
<b>Tests prescribed</b>	<ul style="list-style-type: none"> <li>• ISO15502 test procedure (or IEC 62552 edition 1).</li> <li>• Energy efficiency test at ISO Tropical temperature of 32°C.</li> <li>• Freezer test package required.</li> </ul>	-

### Labelling criteria

The star rating of a refrigerator is determined as an Energy Efficiency Factor ratio (EEF ratio) using the adjusted volume.

The applicable equations and limits are as follows:



- $EEF_{Average} (1 \text{ Door}) = 1.37 \times V_{Adjusted} - 63.3$
- $EEF_{Average} (2 \text{ Door}) = 0.409 \times V_{Adjusted} + 119.5$

Vadj is the adjusted volume and is calculated as follows:

$$V_{adj} = K_c \times \text{Actual volume of the compartment}$$

$K_c$  is the volume correction factor for a particular type of compartment and is defined as follows:

**Table 44: Volume correction factors**

Compartment Type	Volume Correction Factor ( $K_c$ )
<b>Defrost (frost free) (frozen compartments)</b>	1.2
<b>3 star (***) freezer</b>	2.22
<b>2 star (**) freezer</b>	1.96
<b>1 star (*) freezer</b>	1.69

The star index will be calculated as follows:

$$\text{Star Index} = [(EEF_{tested}/EEF_{Average}) - 1] \times 100 \%$$

EEF is calculated in terms of adjusted volume per daily electricity consumption in kWh per day.

EEF<sub>tested</sub> is the value of EEF for that particular type of refrigerator, calculated as follows:

$$EEF_{tested} = V_{adj} / (\text{Consumption in kWh/day})$$

The freezer compartments are described as follows:

The star rating is allocated as follows:

**Table 45: Grading scheme for refrigerators**

Star Rating	Star Index
<b>5</b>	Star index $\geq 25\%$
<b>4</b>	$25\% > \text{Star index} \geq 10\%$
<b>3</b>	$+10\% > \text{Star index} \geq -10\%$
<b>2</b>	$-10\% > \text{Star index} \geq -25\%$
<b>1</b>	Star index $< -25\%$

### 6.3.4. Refrigerator programme in Thailand<sup>28</sup>

In order to improve the overall level of energy efficiency in the appliance sector in Thailand, the government of Thailand enacted the ECP Act in 1992, which provided the relevant authorities such as Electricity Generating Authority of Thailand (EGAT) the power to implement standards and labelling programs for appliances.

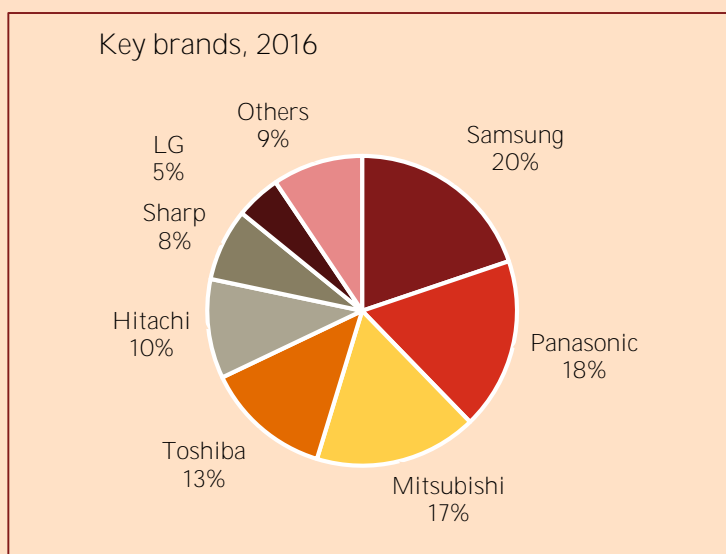
Subsequently, a voluntary labelling programme - the Energy Efficiency Labelling No. 5 Programme was established in 1993 with the objective to inform consumers that No. 5 labelled appliances/equipment are standardized and hence will reduce their electricity bills.

The energy efficiency program for household refrigerators was introduced in 1994, touted under the voluntary regime, which uses a categorical system from Grade 1 (worst) to Grade 5 (best).

#### Refrigerator market in Thailand

The Thai market for refrigerators is primarily divided into two broad categories:

- Top freezer (75%)
- Bottom freezer (8%)
- Others (17%)





Thailand is a manufacturing hub for most of the major manufacturers /brands of refrigerators. The country is a net exporter of refrigerators. In their local markets the most common refrigerator used is double door 250l-450l.

**HCFC R-22 is the major refrigerant used in Thailand.**

<sup>28</sup> Source: REVIEW OF REFRIGERATOR ENERGY EFFICIENCY THRESHOLDS IN SELECTED ASIAN COUNTRIES, Energy Efficient strategies for the Australian Government, Final Report, Australia, April 2014.

In 2002, for the labelling scheme a threshold was defined i.e. the refrigerators which qualify for EGAT Grade 3 and above were only allowed under the voluntary labelling scheme. The EGAT Grade 3 was defined as MEPS for the comparative labelling programme.

*Table 46: Details of labelling programs for refrigerators in Thailand*

<b>Label Design</b>	Comparative label 	Endorsement label 
<b>Program Type</b>	Voluntary	Voluntary (only which qualify for EGAT Grade 5)
<b>Scope &amp; Technical Specifications</b>	Voluntary energy labelling for refrigerating appliances intended for household and similar use, being manufactured or imported, coming under the following categories: <ul style="list-style-type: none"> <li>• Conventional or Inverter type refrigerators.</li> <li>• Top or bottom freezers, Mini, Side by Side, French door, Freezer less and others.</li> <li>• Manually, Semi-automatically or automatically defrosted.</li> </ul>	
<b>Categories specified</b>	Four different categories are mentioned for energy labelling scheme: <ul style="list-style-type: none"> <li>• Single door refrigerator with adjusted volume &lt;100l</li> <li>• Single door refrigerator with adjusted volume <math>\geq 100l</math></li> <li>• Double door refrigerator with adjusted volume &lt;450l</li> <li>• Double door refrigerator with adjusted volume <math>\geq 450l</math></li> </ul>	
<b>Programme Active Since</b>	1994 and subsequently amended in 2002	
<b>Implementing body</b>	Electricity Generating Authority of Thailand (EGAT)	
<b>Key Stakeholders</b>	<ul style="list-style-type: none"> <li>• Industry Associations</li> <li>• Test Labs</li> <li>• Department of Alternative Energy Development and Efficiency (DEDE)</li> <li>• Thai Industrial Standards Institute (TISI)</li> <li>• Electricity Generating Authority of Thailand (EGAT)</li> <li>• National Energy Policy Council (NEPO)</li> <li>• International Organization for Standardization (ISO)</li> <li>• Energy Regulatory Commission (ERC)</li> <li>• Thailand Environment Institute (TEI)</li> </ul>	

	<ul style="list-style-type: none"> <li>Thailand Business Council for Sustainable Development (TBCSD)</li> <li>Manufacturers (Toshiba, Samsung, Panasonic, Hitachi etc.)</li> </ul>
<b>Parameters Graded</b>	Annual Energy Consumption (Ec) (kWh/year)
<b>Label Brand Range</b>	Grade 1 (worst) to Grade 5 (best).
<b>Parameters displayed on the label</b>	<ul style="list-style-type: none"> <li>Grade (in no.) as per the label</li> <li>Year of certification criteria</li> <li>Type of appliance</li> <li>Energy consumption (kWh/year)</li> <li>Electricity cost (Baht/year)</li> <li>Energy efficiency ratio</li> <li>Product Details like model number, model name, brand name</li> </ul>
<b>Minimum Qualification Requirements</b>	As per the implementation of MEPS, Grade 3 is the minimum energy rating.
<b>Tests Prescribed</b>	<ul style="list-style-type: none"> <li>TIS 2186-2547:2004 or ISO15502 test procedure (or IEC 62552 edition 1).</li> <li><b>Energy efficiency test at ISO Tropical temperature of 32°C.</b></li> <li>Freezer test packages are not used in the test.</li> </ul>

### Energy labelling for refrigerators

The star rating of a refrigerator is determined as an Annual Energy Consumption (in kWh) using the adjusted volume.

The Adjusted Volume is calculated as follows:

$$AV = (V_f \times K) + V_r$$

Where AV is adjusted volume, in cubic decimeters,  $V_f$  is frozen food storage compartment volume, in cubic decimeters,  $V_r$  is fresh food storage compartment volume, in cubic decimeters, and K is constant factor, calculated by the formula as follows:

$$K = (32 - t_f) / (32 - t_m)$$

Where  $t_f$  is frozen food storage compartment temperature, in degrees Celsius, and  $t_m$  is fresh food storage compartment temperature, in degrees Celsius.

The grading is allocated as follows:

*Table 47: Grading scheme for refrigerators*

Adj Vol (AV)	Grade 3	Grade 4	Grade 5
<100l	$Ec \leq 0.74AV + 278$	$Ec \leq 0.68AV + 255$	$Ec \leq 0.62AV + 233$
$\geq 100$ L	$Ec \leq 0.43AV + 158$	$Ec \leq 0.39AV + 145$	$Ec \leq 0.36AV + 133$
< 450 L	$Ec \leq 0.43AV + 423$	$Ec \leq 0.39AV + 388$	$Ec \leq 0.36AV + 354$
$\geq 450$ L	$Ec \leq 0.74AV + 423$	$Ec \leq 0.68AV + 388$	$Ec \leq 0.62AV + 354$

## Test Standards<sup>29</sup>

The test prescribed for standardization of refrigerators is Energy Consumption test, in accordance with ISO15502 at an ISO tropical temperature of 32°C.

The calculated energy consumption  $E_x$  at a particular temperature  $t_x$  is given by the equation:

$$E_x = E_1 + (E_2 - E_1) \times (t_x - t_1) / (t_2 - t_1)$$

Where:

- $t_1$  = measured compartment temperature for point 1
- $t_2$  = measured compartment temperature for point 2
- $t_x$  = target temperature for the compartment for energy consumption determination
- $E_1$  = measured energy consumption of the appliance at point 1
- $E_2$  = measured energy consumption of the appliance at point 2
- $E_x$  = calculated energy consumption of the appliance at the target temperature  $t_x$ .

For the given conditions,  $t_x = 32^\circ\text{C}$  and  $E_x = E_{32}$

### 6.3.5. Refrigerator programme in India

Energy efficiency program for refrigerators in India came into focus in the year 2009, as the program for Frost Free Refrigerators was brought under comparative labelling scheme, under the mandatory regime of Bureau of Energy Efficiency.

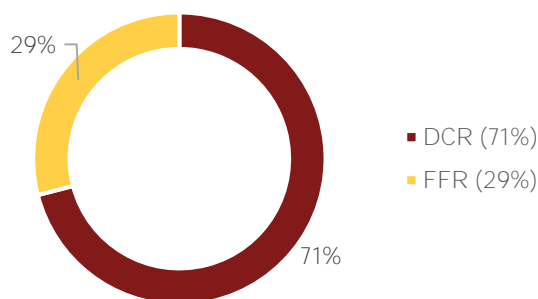
The comparative labelling program for Direct Cool Refrigerators was active since 2006, first under the voluntary regime until 2016, after which the product was brought under the mandatory regime.

#### Refrigerator market in India:<sup>30</sup>

India is a net importer of refrigerators. Although India has big locally manufacturing refrigerating brands like Whirlpool. Most common refrigerators are double door 250L -600L.

The Indian market for refrigerators is primarily divided into two categories: Direct Cool Refrigerators (DCRs) and Frost Free Refrigerators (FFRs).

#### Refrigerator market (2017)



#### DCRs are marked by the following features:

- They use natural convection as their refrigeration mechanism.
- Due to the usage of natural convection mechanism, they provide instant cooling.
- They require to be defrosted manually, because of the absence of any thermostat mechanism.
- Their capacity range is about 50l-250l.
- They are predominantly available as single door refrigerators.

#### FFRs are marked by the following features:

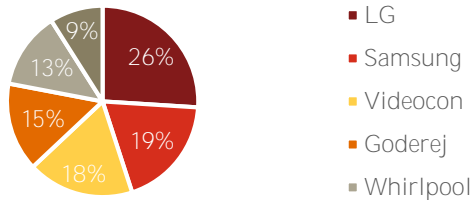
- These refrigerators use electric fans for the refrigeration mechanism.
- Due to the usage of electrical cooling, they are able to maintain consistent temperatures, thus keeping the items fresh for a longer period of time.

<sup>29</sup> Source: TIS 2186-2547 (2004)

<sup>30</sup> Source: [https://www.edelresearch.com/showreportpdf-37397/CONSUMER\\_DURABLES\\_-\\_HOME\\_RUN-JUL-17-EDEL](https://www.edelresearch.com/showreportpdf-37397/CONSUMER_DURABLES_-_HOME_RUN-JUL-17-EDEL) as retrieved on 5th March, 2018.

- The manual defrosting/deicing is not required for these refrigerators.
- Their volume range is 50l-650l. There are different types of refrigerators available within the FFRs (double, triple, side by side, French doors, Wine and drink coolers etc.)

**Both direct cool and frost-free segments are expected to record healthy growth with the industry expected to post 12% YoY growth in 2017.**



Key brands in the refrigerator markets in India include 5 major brands: LG, Samsung, Videocon, **Godrej and Whirlpool control around 90% of the market share**

**The most common refrigerant is HCFC R-22**

The details of active programs are summarized below:

*Table 48: Details of labelling program for refrigerators in India*

<b>Label design</b>		
<b>Program type</b>	Mandatory Comparative	
<b>Scope &amp; technical specifications</b>	Energy labelling requirements for electric mains powered Direct Cool refrigerating appliance of the vapour compression type intended for household and similar use being manufactures, imported, or sold in India.	Energy labelling requirements for electric mains powered Frost Free (No-Frost) refrigerating appliance of the vapour compression type intended for household and similar use being manufactures, imported, or sold in India.
<b>Residential/commercial</b>	<b>Residential refrigerators: 50l-700l</b>	
<b>Active since</b>	For DCR: 2016 (Voluntary from 2006-2016)	For FFR: 2009
<b>Implementing body</b>	Bureau of Energy Efficiency (BEE)	

<b>Key stakeholders</b>	<ul style="list-style-type: none"> <li>• Industry Associations</li> <li>• Test Labs</li> <li>• CLASP</li> <li>• Bureau of Energy Efficiency (BEE)</li> <li>• Bureau of Indian Standards (BIS)</li> <li>• Manufacturers (LG, Godrej etc.)</li> </ul>	
<b>Parameters graded</b>	Annual Energy Consumption (AEC)	
<b>Label Band range</b>	1 star (worst) to 5 stars (best)	
<b>Parameters displayed on the label</b>	<ul style="list-style-type: none"> <li>• Star Label</li> <li>• Electricity Consumption</li> <li>• Label Period</li> <li>• Appliance/Type</li> <li>• Model/Year</li> <li>• Type</li> <li>• Gross Volume</li> <li>• Storage Volume</li> <li>• BEE Logo</li> <li>• Disclaimer for calculation of electricity consumption</li> </ul>	
<b>Minimum qualification requirements</b>	<ul style="list-style-type: none"> <li>• Minimum threshold of Star Rating Band</li> <li>• Manufacturing and Testing tolerance as prescribed by the Bureau of Indian Standards</li> </ul>	
<b>Test standard</b>	<ul style="list-style-type: none"> <li>•</li> </ul>	
<b>Tests prescribed</b>	<ul style="list-style-type: none"> <li>• Star Rating Band Calculation</li> <li>• Pull Down Test</li> </ul>	<ul style="list-style-type: none"> <li>• Star Rating Band Calculation</li> <li>• Pull Down Test</li> <li>• Operating Temperature Performance Test</li> </ul>

### Star Rating Bands for FFRs:<sup>31</sup>

The Star Rating Band (SRB) shall be calculated as follows:

$$(SRB)_{ff} = k_{dc} * V_{adi\_tot\_dc} + C_{dc}$$

Where  $k_{dc}$  = Constant multiplier (kWh/litre/Year),  $V_{adi\_tot\_dc}$  = Total adjusted storage volume for household direct cool refrigerator (litre),  $C_{dc}$  = Constant fixed allowance (kWh/Year)

- The comparative energy consumption (CEC) for a model (i.e., annual electricity consumption that appear on label) shall not be less than the average annual energy consumption (AEC).

$$AEC = E_i * (365/1000) \text{ (kWh/Year)}$$

Where  $E_i$  = tested energy consumption expressed in Watt hour per 24 hours, (rounded to the nearest whole number as IS 2:1960, reaffirmed 2000, Edition 2.3.)

- Star rating band valid from the date of notification to 31st December, 2018:

<sup>31</sup> Source: <https://www.beestarlabel.com/Content/Files/FFRnoti.pdf> as retrieved on 5th March, 2018.

**Table 49: Grading scheme for frost free refrigerators**

Star Rating Band	CEC Criteria
1 Star*	$0.264 * V_{adi\_tot\_dc} + 221 \leq CEC < 0.33 * V_{adi\_tot\_dc} + 277$
2 Star**	$0.211 * V_{adi\_tot\_dc} + 177 \leq CEC < 0.264 * V_{adi\_tot\_dc} + 221$
3 Star***	$0.169 * V_{adi\_tot\_dc} + 141 \leq CEC < 0.211 * V_{adi\_tot\_dc} + 177$
4 Star****	$0.135 * V_{adi\_tot\_dc} + 113 \leq CEC < 0.169 * V_{adi\_tot\_dc} + 141$
5 Star*****	$CEC < 0.135 * V_{adi\_tot\_dc} + 113$

$V_{adi\_tot\_dc}$  is the adjusted volume. It is calculated as follows:

$$V_{adi\_tot\_dc} = (V_f \times K) + V_r$$

Where AV is adjusted volume, in cubic decimeters,  $V_f$  is frozen food storage compartment volume, in cubic decimeters,  $V_r$  is fresh food storage compartment volume, in cubic decimeters, and K is constant factor, calculated by the formula as follows:

$$K = (32 - t_f) / (32 - t_m)$$

Where  $t_f$  is frozen food storage compartment temperature, in degrees Celsius, and  $t_m$  is fresh food storage compartment temperature, in degrees Celsius.

**Star Rating band for DCRs:<sup>32</sup>**

- The star level of the household direct cool refrigerator shall be determined on the basis of star level parameters, constant multiplier (kWh/litre/year) –  $k_{dc}$  and constant fixed allowance (kWh/Year) -  $C_{dc}$ , which shall be depend on the year of manufacturing or commercial purchase or sale.

$$(SRB)_{dc} = k_{dc} * V_{adi\_tot\_dc} + C_{dc}$$

Where  $k_{dc}$  = Constant multiplier (kWh/litre/Year),  $V_{adi\_tot\_dc}$  = Total adjusted storage volume for household direct cool refrigerator (litre),  $C_{dc}$  = Constant fixed allowance (kWh/Year)

- Star level valid for one year from the date of coming into force of regulations:

**Table 50: Grading scheme for direct cool refrigerators**

Star Rating	$k_{dc}$	$C_{dc}$
1 Star*	0.8716	759
2 Star**	0.6973	607
3 Star***	0.5578	486
4 Star****	0.4463	389
5 Star*****	0.3570	311

<sup>32</sup> Source: <https://www.beestarlabel.com/Content/Files/DCR%20notification.pdf> as retrieved on 5<sup>th</sup> March, 2018.



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$V_{\text{adi\_tot\_dc}}$  is the adjusted volume. It is calculated as follows:

$$V_{\text{adi\_tot\_dc}} = (V_f \times K) + V_r$$

Where AV is adjusted volume, in cubic decimeters,  $V_f$  is frozen food storage compartment volume, in cubic decimeters,  $V_r$  is fresh food storage compartment volume, in cubic decimeters, and K is constant factor, calculated by the formula as follows:

$$K = (32 - t_f) / (32 - t_m)$$

Where  $t_f$  is frozen food storage compartment temperature, in degrees Celsius, and  $t_m$  is fresh food storage compartment temperature, in degrees Celsius.

## 6.4. Washing machines

### 6.4.1. Washing machine programme in China

China introduced a mandatory labelling programme for washing machines in 2007, which was based on GB12021-2004 and was valid until October 2013. The washing machine labelling program is currently based on GB12021-2013.

The energy label sample of washing machines includes information on **energy consumption** and **water consumption** of a washing cycle, **washing effectiveness** and **the rated washing capacity** of the washing machine. In addition to the mandatory comparative labelling program, China has implemented an endorsement labelling scheme and a MEPS program for washing machines.

China's Energy Label Center (CNIS), NDRC and AQSIQ are responsible for **the program's** implementation.

#### Technologies available in China's market

There are two main technologies of washing machines: drum (front load) and impeller (top load). Twin-tub washing machines were popular in the 1980s and 1990s. However, this type holds only a small market share in rural areas today.

Although the prices of drum washing machines are much higher than those of impeller washing machines, drum washing machines are becoming more popular than impeller washing machines in China. 49% of the washing machines on the Chinese market are drum washing machines, 48% are impeller washing machines and 3% are twin-tub washing machines.<sup>33</sup>

#### Typical usage pattern

Most Chinese families do their washing in cool or cold water that comes directly from the pipe. Apartments very rarely have pressurized warm water supply. So, data on typical washing temperature is very limited. The washing frequency differs widely because of the different family sizes and washing habits.

The details of active programs are summarized below:

*Table 51: Details of labelling program for washing machines in China*

<b>Label design</b>		
	Comparative label	Endorsement label
<b>Program type</b>	Mandatory	Voluntary

<sup>33</sup> Source: Market research of Top10, January 2014

<b>Scope</b>	All washing machines for household use	
<b>Active since</b>	2007, updated 2013	
<b>Implementing body</b>	<b>China Energy Label Center (CNIS)</b>	
<b>Key stakeholders</b>	AOSIQ and CNCA for organization and appointment of local authorities, which along with NDRC, are responsible for organization of market inspection activities.	
<b>Parameters graded Label Band range</b>	<ul style="list-style-type: none"> <li>• Energy Efficiency</li> <li>• Water efficiency</li> <li>• Wash performance</li> </ul>	-
	Tier 1 (best) to Tier 5 (worst)	-
<b>Parameters displayed on the label</b>	<ul style="list-style-type: none"> <li>• Energy consumption per cycle</li> <li>• Water consumption per cycle</li> <li>• Washing effectiveness</li> <li>• Rated wash capacities</li> </ul>	-
<b>Minimum qualification requirements</b>	MEPS value (Tier 5)	Energy Efficiency corresponding to Tier 2
<b>Tests prescribed</b>	<ul style="list-style-type: none"> <li>• Wash performance</li> <li>• Energy consumption per cycle</li> <li>• Water consumption per cycle</li> </ul>	
<b>Test standard followed</b>	<ul style="list-style-type: none"> <li>• JIS 9606 for top loader impellor machines</li> <li>• IEC 60456 for drum type front loaders</li> </ul>	

### Test standards followed<sup>34</sup>

The testing standard for washing machines is defined in the national standard, entitled GB/T 4288- 2008 household and similar electrical washing machine. The testing method measures the same performance variables for both types of washing machines, including energy consumption, water consumption and washing quality. However, the testing conditions for the two types of machines have significant differences:

- Impeller machines are tested using cool water at  $30 \pm 2$  °C. Water is heated from ambient temperatures to the test temperature externally, and the energy used to heat the water is not included in the declared energy consumption. This corresponds to the requirements of JIS 9606.
- Drum washing machines are tested using hot water. For units with an integrated water heater, the washing machine is filled with cold water of  $15 \pm 2$  °C and run at the default standard hot washing setting. For units without an integrated water heater, the washing machine is filled with hot water at  $50 \pm 2$  °C. Again, this water is heated from ambient to target temperature externally and the energy used to heat the water is not included in the declared energy consumption. This corresponds to the requirements of IEC 60456.

<sup>34</sup> Source: BigEE, “Washing Machines in China”, 2014

## Labelling criteria

GB12021.4-2013 defines five energy efficiency tiers for washing machines. Energy consumption per kilogram, water consumption per kilogram and rate of washing effectiveness are the three parameters to define the energy efficiency tiers of the washing machine. Tier 5 corresponds to the MEPS and Tier 1 is the most efficient.

**Machines corresponding to Tier 1 and Tier 2 are eligible for the voluntary endorsement label.**

The requirements for impeller type washing machines and drum type washing machines are maintained differently due to their different test procedures and requirements.

Table 52: Grading scheme for washing machines in China

EE tier	Top load (impeller type)			Front load (drum type)		
	Electricity use (max) KWh per cycle per kg	Water use (max) L per cycle per kg	Cleaning performance (min)	Electricity use (max) KWh per cycle per kg	Water use (max) L per cycle per kg	Cleaning performance (min)
1	0.011	14	0.90	0.11	7	1.03
2	0.012	16	0.80	0.13	8	1.03
3	0.015	20	0.80	0.15	9	1.03
4	0.017	24	0.80	0.17	10	1.03
5	0.022	28	0.80	0.19	12	1.03

## Calculation of energy and water consumption per cycle

Launched in 2004, the first energy efficiency standard was based on GB/T 4288-2003 and promulgated under GB 12021.4-2004, under which energy and performance consumption values were determined at full load for a given test machine.

However, the revised standard GB 12021.4-2013, implemented since 2013, adds the half-load test in the process of measuring energy consumption per kilogram and water consumption per kilogram. The formula for determination of energy consumption per kilogram is reproduced below:

$$E_e = I_e \times \frac{E_1 + 2E_2}{2m}$$

$E_e$  = Energy consumption per kg  
 $I_e$  = Energy efficiency compensation coefficient (0.75 for impeller, 0.85 for drum)  
 $E_1$  = Energy consumption at full load  
 $E_2$  = Energy consumption at half load  
 $m$  = rated capacity (in kg)

The formula to determine water consumption per kg is reproduced below:

$$W_e = I_w \times \frac{W_1 + 2W_2}{2m}$$

$W_e$  = Water consumption per kg  
 $I_w$  = Water efficiency compensation coefficient (0.75)  
 $W_1$  = Water consumption at full load  
 $W_2$  = Water consumption at half load  
 $m$  = rated capacity (in kg)

## 6.4.2. Washing machine programme in Singapore<sup>35</sup>

The PUB (Singapore’s National Water Agency) started the Mandatory Water Efficiency Labelling Scheme (WELS) in 2009 to increase the efficient use of water in the country. In 2017, the Mandatory WELS scheme was extended to cover washing machines.

The grading in the label is conducted in the form of Ticks – with 1 Tick provided to the least efficient product, and 4 Ticks to the most efficient product.

### Labelling criteria

The label grade is determined on the basis of the washing machine model’s water factor – ratio of wash volume in L and its wash capacity in kg.



Table 53: Grading scheme for washing machines in Singapore

Water efficiency class	Range of Water factor (WF)
<b>1 Tick</b>	-
<b>2 Ticks</b>	$9 < WF \leq 12$ L/kg
<b>3 Ticks</b>	$6 < WF \leq 9$ L/kg
<b>4 Ticks</b>	$WF \leq 6$ L/kg

**A water factor of 12 L/kg is the maximum allowed for the attaining the label.**

## 6.4.3. Washing machine programme in Thailand

A voluntary endorsement labelling program for washing machines has been active in Thailand since 2007.<sup>36</sup> The label, called the “Green Label” is awarded to those models with low water and energy consumptions. In addition, the EGAT label no. 5 – a voluntary comparative labelling program- was engaged for washing machines in 2013. However, the status of its implementation is unclear at present.

The green label program applies to washing machines for household use and similar functions, used with alternate currents of not more than 250 volts for single phase, and not more than 480 volts for 3 phase, either with or without heating equipment, providing hot or cold washes, including combination washer dryers.

Washing machines not intended for household use are also included under this program.

The details of the Green label program are summarized below:

Table 54: Details of labelling program for washing machines in Thailand

<p><b>Label design</b></p>	
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<sup>35</sup> Source: WELS Products, accessed on 20 February 2018

<sup>36</sup> Source: <https://clasp.ngo/policies>, retrieved on 21 February 2018

<b>Program type</b>	Endorsement label
<b>Scope &amp; technical specifications</b>	The green label program applies to washing machines for household use and similar functions, used with alternate currents of not more than 250 volts for single phase, and not more than 480 volts for 3 phase, either with or without heating equipment, providing hot or cold washes, including combination washer dryers.  Washing machines not intended for household use are also included under this program.
<b>Residential/commercial</b>	Both
<b>Active since</b>	2007
<b>Implementing body</b>	Thailand Environment Institute (TEI)
<b>Parameters graded Label Band range</b>	Not applicable
<b>Parameters displayed on the label</b>	Not applicable
<b>Minimum qualification requirements</b>	<ul style="list-style-type: none"> <li>• Minimum wash performance</li> <li>• Energy consumption</li> <li>• Water consumption</li> <li>• Noise</li> </ul>
<b>Test standard</b>	<ul style="list-style-type: none"> <li>• TGL-13-R1-07</li> <li>• TIS 1462, based on IEC 60456 for front loaders and JIS 9606 for top loaders</li> </ul>
<b>Tests prescribed</b>	<ul style="list-style-type: none"> <li>• Wash performance</li> <li>• Energy consumption</li> <li>• Water consumption</li> <li>• Noise</li> </ul>

## Minimum requirements

Table 55: Minimum qualification requirements

Parameter	Requirement			
Wash performance (%)	Minimum 80%			
Cold wash energy consumption (Wh/kg)	<b>6 kg</b>	<b>7-8 kg</b>	<b>9-10 kg</b>	<b>11-12 kg</b>
<i>If machine is not capable of performing washes with hot water</i>	≤ 25	≤ 20	≤ 16	≤ 13
Hot wash energy consumption (Wh/kg)	≤170			
Amount of water consumed (L/kg)	<b>6 kg</b>	<b>7-8 kg</b>	<b>9-10 kg</b>	<b>11-12 kg</b>
	≤ 28	≤ 26	≤ 24	≤ 22
Noise in dB (A)	<b>While washing</b>		<b>While drying</b>	

	≤ 50	≤ 55
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**Other requirements**

The technical documentation TGL-13-R1-07 specifies that no halogens be used in synthetic resins in components weighing more than 25 grams, except electrical cords and electronic parts.

Further, if fire retardants are used in synthetic resins weighing more than 25 grams which is a component for the drum, the product must be made from materials which does not have additives such as Polybrominated biphenyls (PBBs), Polybromodiphenyl Ethers (PBDEs), and short-chain Chlorinated Paraffins (C=10-13) which consist of more than 50 percent of fire-retardant Chlorine.

**Prescribed test methods**

Testing for characteristics, safety, and competency of the washing machine, as well as testing for electricity and water consumption shall be in accordance with the Thai Industrial Standard for Clothes Washing Machines for Household Use, TIS 1462. *We believe TIS 1462 is mostly aligned with IEC 60456 for front loading washing machines and JIS C 9606 for vertical axis washing machines. However, analysis of TIS 1462 is not possible at this stage due to language barriers.*

Measurements of electricity and water consumption shall be done under the same testing conditions as the test for competency of cleaning, washing, and spin-drying (if available) of the washing machines.

Testing for noise shall be in accordance with JIS C 9606 no. 8.7 or EN 60704-2-4, or other acceptable national standards.

**6.4.4. Washing machine programme in UAE<sup>37</sup>**

The Emirates Authority for Standardization and Metrology (ESMA) has prepared the standard **UAE.S 5010-2:2012** which deals with mandatory energy efficiency labelling of Washing Machines and Dryers in the UAE.

This regulation is developed to ensure that washing machines and dryers are registered and monitored for their continuous compliance to the set specifications on factors such as energy consumption, water consumption, spin extraction performance, and condensation efficiency.

The details of the program are summarized below:

*Table 56: Details of labelling program for washing machines in the UAE*

<p><b>Label design</b></p>	
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<sup>37</sup> Source: UAE S 5010-2, 2013 (English)

<b>Program type</b>	Mandatory comparative label
<b>Scope &amp; technical specifications</b>	All clothes washing machines for household use, with or without heating devices and for cold and/or hot water supply. Washing machines for communal use in block of flats or in laundrettes up to 20kg capacity are also included.
<b>Residential/commercial</b>	<b>Residential only</b>
<b>Active since</b>	2010
<b>Implementing body</b>	Emirates Authority for Standardization and Metrology (ESMA)
<b>Parameters graded</b>	Energy efficiency, Spin drying efficiency
<b>Label Band range</b>	1 star (least) to 5 star (best)
<b>Parameters displayed on the label</b>	<ul style="list-style-type: none"> <li>• Annual energy consumption (KWh/year)</li> <li>• Annual water consumption (L/year)</li> <li>• Capacity (kg)</li> <li>• Brand name, model number etc.</li> <li>• Disclaimer for calculation of electricity consumption</li> </ul>
<b>Minimum qualification requirements</b>	Safety requirements
<b>Test standard</b>	<ul style="list-style-type: none"> <li>• UAE.S IEC 60456: 2010</li> <li>• UAE.S IEC 61121:2012</li> <li>• UAE.S IEC 62512:2012</li> </ul>
<b>Test conditions</b>	<p>The 60°C cotton program shall be used without pre-wash in accordance with the <b>manufacturer's instruction; if it's not there the manufacturer can declare it. And the cold water temperature should be 25±2°C.</b></p> <p>In cases of washing machines without any programs, the recommended times for Washing, rinsing, and spin extracting operations shall be in accordance with the <b>manufacturer's instructions for the rated washing capacity to be tested.</b></p>
<b>Tests prescribed</b>	<ul style="list-style-type: none"> <li>• Energy consumption</li> <li>• Water consumption</li> <li>• Spin Extraction Performance for Washing Machines</li> <li>• Condensation Efficiency for Condenser Dryers</li> </ul>
<b>Implementation and Monitoring &amp; Verification procedure</b>	<ul style="list-style-type: none"> <li>• A test report on one sample of the model is to be submitted to the relevant authority for verification.</li> <li>• If the test results of one sample indicate that any of the measured is greater than the rated value by more than 10%, two more tests are required. In such a case, for each individual test the values shall not be greater than the rated values by more than 10 %.</li> <li>• Also, the information on the energy label shall be based on the higher values (lower efficiency)</li> </ul>



## Measurement of Water Consumption

The water consumption (liters/cycle) shall be measured during the energy consumption test in accordance with UAE.S IEC 60456: 2010 and UAE.S IEC 62512:2012.

This maximum water consumption allowable is as per the following formula:

- For drum type →  $WC \leq (5 * C + 35)$  Litres
- For top loading type →  $WC \leq (20 * C + 35)$  Litres

Where C = washing capacity (kg) & WC = the water consumption of the default 60°C declared standard cycle (Litres)

## Energy Efficiency Classes

The energy efficiency class of a household washing machine shall be determined in accordance with its Energy Efficiency ratio (EER), which is defined as:

$$EER = \frac{E}{CR}$$

Where E: average of energy consumption for two units for average of three cycles for each unit

C: rated capacity of the unit (kg)

*Table 57: Grading scheme for energy efficiency*

EE class	Range of EER values (Wh/kg)	
	Drum type	Top load & twin tub types
<b>5 star</b>	EER < 90	EER < 14
<b>4 star</b>	90 ≤ EER < 110	14 ≤ EER < 17
<b>3 star</b>	110 ≤ EER < 130	17 ≤ EER < 20
<b>2 star</b>	130 ≤ EER < 150	20 ≤ EER < 23
<b>1 star</b>	150 ≤ EER < 170	23 ≤ EER < 26

## Spin drying efficiency Classes

The spin drying efficiency class is determined in accordance with the Remaining Moisture Content (RMC), which is determined as shown below:

$$RMC = \frac{M_r - M}{M} \times 100$$

Where, M: mass of the conditioned load.

Mr: mass of the loose load after spin extraction

*Table 58: Grading scheme for spin drying efficiency*

Spin drying efficiency class	RMC (%)
<b>5 star</b>	RMC < 50
<b>4 star</b>	50 ≤ RMC < 60
<b>3 star</b>	60 ≤ RMC < 70


<b>2 star</b>	$70 \leq RMC < 80$
<b>1 star</b>	$80 \leq RMC < 90$

### 6.4.5. Washing machine programme in Hong Kong<sup>38</sup>

The government of Hong Kong introduced the Mandatory Energy Efficiency Labelling Scheme (MEELS) through the Energy Efficiency (Labelling of Products) Ordinance, Cap. 598. Under MEELS, energy labels are required to be shown on the prescribed products for supply in Hong Kong to inform consumers of their energy efficiency performance.

Washing machines were added under the Ordinance first in 2010, and the requirements were modified subsequently in 2013.

The details of active programs are summarized below:

<b>Label design</b>	
	Comparative label
<b>Program type</b>	Mandatory
<b>Scope &amp; technical specifications</b>	All residential washing machines
<b>Residential/commercial</b>	<b>Residential</b>
<b>Active since</b>	2010, revised 2013
<b>Implementing body</b>	The Director, Electrical and Mechanical Services
<b>Parameters graded Label Band range</b>	Energy Efficiency
	Grade 1 (Best) to Grade 5 (Worst)
<b>Parameters displayed on the label</b>	<ul style="list-style-type: none"> <li>Annual energy consumption (kWh/year)</li> <li>Wash capacity</li> <li>Water consumption</li> </ul>

<sup>38</sup> Source: 12. “Code of Practice on Energy Labelling of Products”, Hong Kong, 2014

	<ul style="list-style-type: none"> <li>Model number, brand details etc.</li> </ul>
<b>Minimum qualification requirements</b>	Adherence to the MEPS requirements
<b>Test standard</b>	<ul style="list-style-type: none"> <li>IEC 60456 (for front loaders)</li> <li>JIS C 9606 (for top loaders)</li> </ul>
<b>Tests prescribed</b>	<ul style="list-style-type: none"> <li>Wash performance</li> <li>Energy consumption</li> <li>Water consumption</li> <li>Spin drying efficiency</li> </ul>

## Minimum requirements

Table 59: Minimum requirements

Parameter	Horizontal axis washing machines	Vertical axis washing machines
Test standard followed	IEC 60456	JIS C 9606
Washing performance	≥ 70%	C ≥ 0.55
Water extraction performance	Remaining moisture content ≤ 1.1	Water extraction efficiency ≥ 0.47

If a machine does not adhere to the above requirements, it is deemed ineligible for Labelling grades 1 to 4.

## Prescribed test methods

The energy and water performance tests are to be carried out as per IEC 60456 for horizontal-axis washing machines and JIS C 9606 for vertical-axis washing machines. For horizontal-axis washing machines, the 60°C cotton programme is used without pre-wash. For vertical-axis washing machines, the temperature of water is 30±2° C.

A test report submitted by a manufacturer must consist of the following information:

- Energy consumption
- Water consumption
- Washing performance
- Water extraction performance

## Energy efficiency grading scheme

A washing machine model is given an energy efficiency grade from 1 to 5, with 1 being the best and 5 the worst. The energy efficiency grade of a model is determined on the basis of its specific energy consumption.

The grading scheme is shown below:

Table 60: Grading scheme for washing machines

Energy efficiency grade	Specific energy consumption (KWh/kg/cycle)	
	Horizontal axis type	Vertical axis type
1	≤ 0.130	≤ 0.0160

2	0.130 to 0.150	0.0160 to 0.0184
3	0.150 to 0.172	0.0184 to 0.0208
4	0.172 to 0.195	0.0208 to 0.0232
5	> 0.195	> 0.0232

### Calculation of specific energy consumption

The specific energy consumption of a washing machine is calculated as follows:

- For horizontal axis washing machine with built-in water heating device and vertical axis washing machine, the specific energy consumption is calculated as follows:

$$\text{Specific Energy Consumption (E}_{sp}\text{)} = \frac{E}{W_r}$$

where E = measured energy consumption per cycle (kWh/cycle)

and  $W_r$  = rated washing capacity (kg)

- For horizontal axis washing machine without built-in water heating device, the specific energy consumption is calculated as follows:

$$\text{Specific Energy Consumption (E}_{sp}\text{)} = \frac{E+W_h}{W_r}$$

where E = measured energy consumption per cycle (kWh/cycle)

$W_h$  = calculated hot water energy (kWh/cycle)

and  $W_r$  = rated washing capacity (kg)

- The calculated hot water energy is the theoretical energy requirement for heating water from 15° C to 60° C and shall be calculated as follows:

$$W_h = \frac{V_h \times (60 - 15)}{860}$$

where  $V_h$  = the volume of external hot water used in litres during the operation

### Other requirements

In addition to the energy efficiency performance requirements, all washing machines must comply with the Electrical Products (Safety) Regulation, Chapter 406G of the Laws of Hong Kong, and the safety standards specified under the Regulation, and all other legislations concerning the safety of the washing machines.

## 6.5. Brief overview of the S&L programme implementation details in countries referred

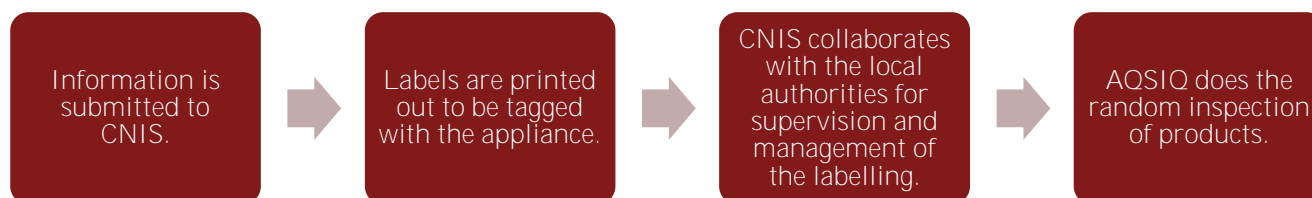
### 6.5.1. Programme in China

**The China Energy Label Center (CNIS) is responsible for the overall implementation and M&V of the labelling program.**

The overall implementation of the labelling program is as follows:

- Individual enterprises (i.e. manufacturers and importers) are required to independently determine the energy efficiency levels of their products as per relevant standards, and determine the labelling information. The labels are then printed and pasted on the models sold in the market. The information present on the models is submitted to CNIS, and the enterprises are responsible for overall accuracy of information submitted.
- The CNIS is responsible for system research, preparation of implementing rules, filing management, publicity and promotion, system evaluation, and special random market inspection. CNIS frequently collaborates with local authorities for quality supervision and management (for supervision and market surveillance activities).
- AOSIQ and CNCA are responsible for organization and appointment of local authorities for quality supervision and management of the labelling scheme. AOSIQ also develops annual random inspection of products focusing on energy efficiency indicators. NDRC and other competent authorities organize and develop special market inspection on energy efficiency label.

The registration process for the labelling scheme is as shown below:



*Figure 6: Registration process in China's labelling program*

Local enforcement bodies supervise over the execution of energy efficiency labelling system by enterprises. They also conduct inspection on implementation of energy efficiency labelling system, and develop social supervision among the public and industrial agencies.

### 6.5.2. Programme in Singapore

The National Energy Agency (NEA) is responsible for the overall implementation of the labelling program in Singapore. Registered suppliers who import or manufacture the following regulated goods are required to register such goods with NEA before they are supplied in Singapore. **Registration shall be made online using the ELS Online Portal.**

The registration requires the **company administrator's SingPass or CorpPass, test report, and a letter of authorization**, if the registration is made by an appointed third-party. The registration process is described below:

- National Environment Agency (NEA) issues the Certificate of Registration (COR) for the model. This is based upon the required test and energy efficiency tests as per ISO/IEC test procedure.
- Registered suppliers who import or manufacture the following regulated goods are required to register such goods with NEA before they are supplied in Singapore. Registration shall be made online using the

ELS Online Portal. **The entire database of models registered with the NEA is available in public domain**

- The registration requires the company administrator's test report, and a letter of authorization, if the registration is made by an appointed third-party.

**The test reports must be provided by laboratories accredited by the Singapore Accreditation Council (SAC), or by other bodies who have a Mutual Recognition Arrangement (MRA) with the SAC, or in the manufacturer's in-house laboratories**

- The application for registration as a registered supplier has no accompanying charge. However, application for registration of air conditioners costs USD 38. Application for renewal costs USD 20.

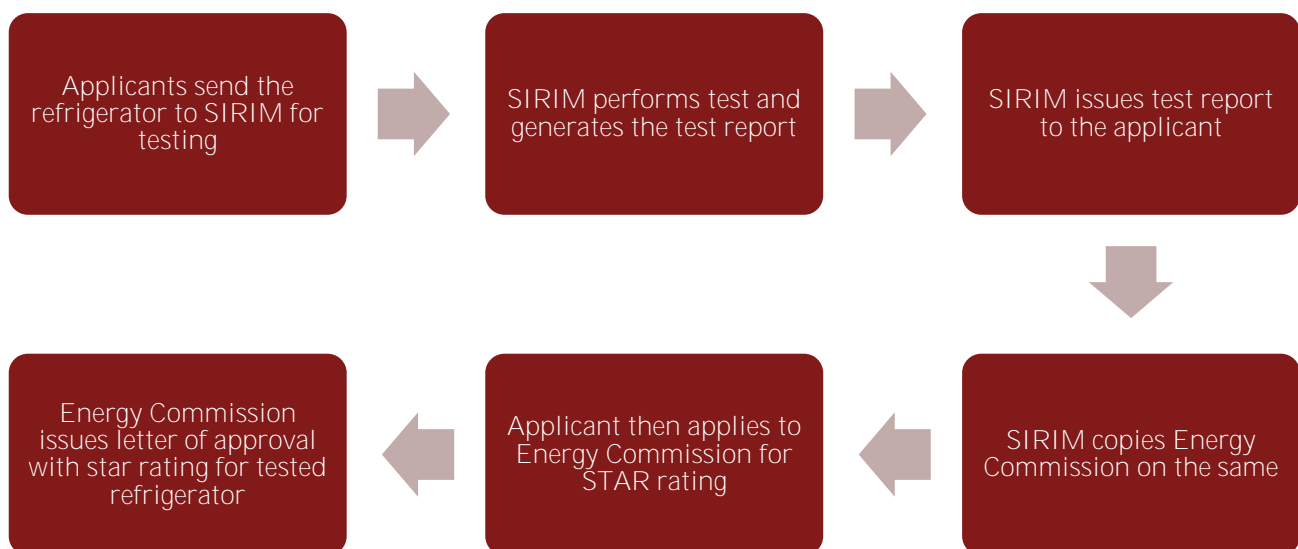
**The registration of split type air-conditioners shall be accompanied by a declaration of the COP100% values for all combinations of indoor units supplied in Singapore**

In addition, **the NEA frequently conducts check testing to ensure the authenticity of the labelling program**. The verification procedure is shown below:

- NEA from time to time carry out verification testing (VT) on registered models. All VTs are carried out in accordance with the applicable test standards. A registered model is deemed to have passed the VT if the energy performance obtained through VT falls within the conformance limits.

### 6.5.3. Programme in Malaysia

The Energy Commission and the SIRIM (Standard and Industrial Research Institute of Malaysia) are responsible for the implementation of the S&L programme in Malaysia. The implementation procedure is summarised below:



*Figure 7: Implementation procedure in Malaysia's labelling program*

### 6.5.4. Programme in Thailand

The Electricity Generating Authority of Thailand (EGAT) is responsible for implementation of the voluntary comparative label EGAT label no. 5, and the Thailand Environment Institute (TEI) is responsible for implementation of the Green Labelling program.

The implementation procedure for the EGAT label is summarised below:

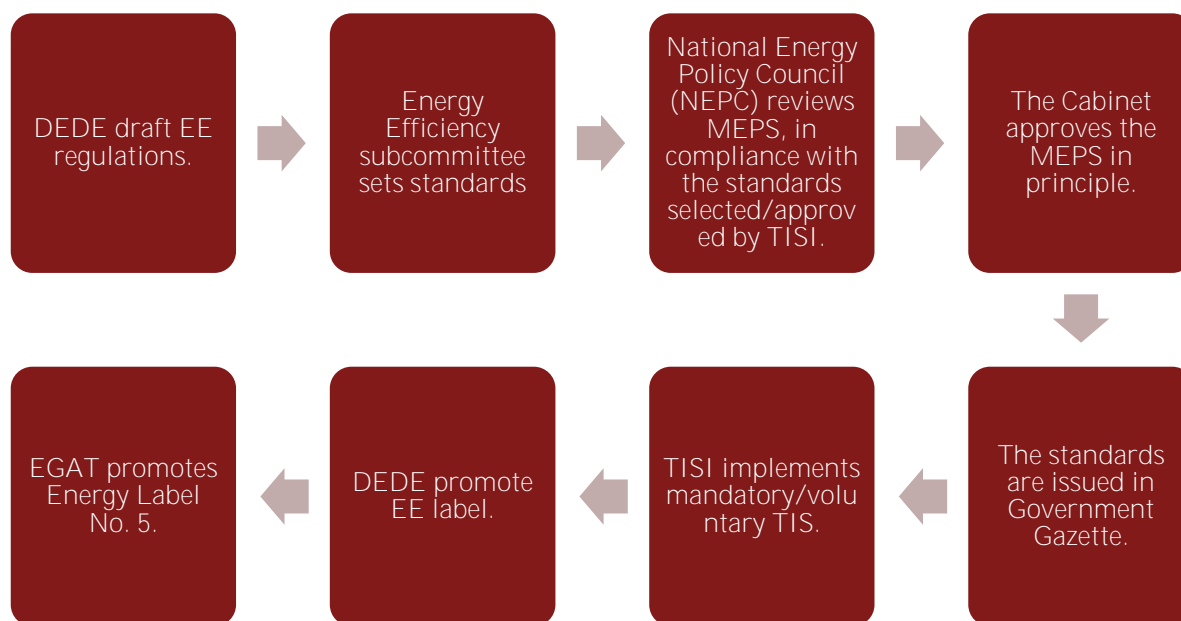


Figure 8: EGAT label's implementation procedure

In addition, EGAT randomly buys Energy Label No. 5 appliances in the market for a retest every year. This is conducted as part of the efforts to maintain the efficiency standards of the labelled appliances. The appliances that fail to meet the earned efficiency rating will be stripped off the labels or have their efficiency rating level lowered. They will then be banned from advertising using the previously earned efficiency rating label.

**Implementation of green labelling program:** The implementation and verification procedure adopted for the Green Labelling program are described in the specific technical regulation. The applicant (i.e. manufacturer or importer) is to submit copies of certificates of confirmation to applicable TIS standards or equivalent standards. If the certificate of compliance is not available, the applicant is required to submit original test reports confirming adherence to the applicable requirements. Testing must be conducted in laboratories operated by the government and certified under the relevant test standard.

### 6.5.5. Programme in India

The standards & labelling program in India is administered, monitored and enforced by the Bureau of Energy Efficiency (BEE). The BEE maintains a dedicated online portal (<http://beestarlabel.com>) to support the administration of the scheme. The portal is used by BEE for 1) Dissemination of information – such as announcement of a new labelling schedule/regulation for a respective product, procedure for application, labelling fees and general updates; 2) Manage the procedure for grant of label; 3) Registration of manufacturers/importers to the portal; etc.

## Procedure for grant of label

Applicants are first required to register themselves on BEE's S&L web portal, once for each product, by paying a one-time registration fee. Necessary documents such as company registration, ISO certification etc., model registration number etc. are to be submitted at the time of the registration.

Once a manufacturer has been registered, they may apply for the label for their individual models by filling out information regarding test standards, performance, etc. as per the prescribed formats. A registration fee of INR 2000 is charged per model.

An IAME (Independent Authority for Monitoring and Enforcement) is engaged by BEE to scrutinise the applications and grant permission to manufacturers/importers to affix the label.

## Procedure for monitoring & enforcement

The BEE has set out a MV&E framework that sets out the principles adopted by the BEE to optimise compliance with the EC Act (2001 and subsequent amendments) and other relevant legislation and regulations relating to the energy labelling of appliances and equipment. Compliance with the S&L scheme is done through check testing and challenge testing.

- **Check testing** - Check testing assesses whether the claims made for the energy performance of individual products by the permittee are accurate under the conditions stipulated in the relevant product regulation/schedule.

The Bureau or its designated agency (IAME or SDA or any other agency), is entitled to conduct *suo motu* check testing of products as per the product schedule or regulation to ensure that product models meet the performance claims. In case the sample drawn for the check testing fails, the Bureau or its designated agency shall conduct a second check testing, for which it shall buy two additional samples of the same model within two weeks.

The permittee/user of the label would be accordingly informed about the failure of the first check testing and shall be advised to deposit the cost of the samples and also the cost of check testing in advance.

The second check testing shall be done in the laboratory where the first check testing was conducted. In case it is not possible to test the second sample in the same laboratory, the sample may be tested in another empanelled laboratory under intimation to the Bureau.

- **Challenge testing** - Challenge testing is carried out as and when, any written complaint is received regarding the information on the star label and/or requirement given in the respective product schedule of the Bureau

## 6.5.6. Programme in Hong Kong

The Code of Practice of the Mandatory comparative labelling scheme in Hong Kong specifies that The Director, Electrical and Mechanical Services shall be responsible for implementation of the MEELS scheme.

Taking refrigerators as the base case, the implementation of the program is described below:

- The governing law is the Energy Efficiency (Labelling of Products) Ordinance that was passed in May 2008. The products that come under the purview of the ordinance are mentioned in its Annexures.
- The ordinance specifies that the Director of Electrical and Mechanical Services Department (the Director) is responsible for the enforcement of the scheme.
- The programme has a self-certification system wherein the manufacturers and importers are required to register all products covered by the programme before they can be sold. An application for registration and necessary documents must be submitted to the Director.



- The Director provides the authority to affix the label based on the information submitted by the applicants and conducts verification and enforcement checks post labelling. The Government of Hong Kong has published a Code of Conduct to guide stakeholders for discharging their duties.
- The Director is authorised to conduct compliance monitoring in order to verify the claims made by manufacturers and importers through verification testing. The samples of products are arranged from the market. The procedure is mentioned in the Code of Conduct.
- Where a product fails an initial screen test on a single sample, a further set of tests on multiple (usually three) samples is used to confirm the non-conformance of the model.

### ***6.5.7. Programme in UAE***

The Emirates Authority for Standardization and Metrology (ESMA) has prepared the standard **UAE.S 5010-2:2012** which deals with mandatory energy efficiency labelling of Washing Machines and Dryers in the UAE. It is responsible for the implementation of the scheme.

A brief summary of the procedure is shared below:

- A test report on one sample of the model is to be submitted to the relevant authority for verification.
- If the test results of one sample indicate that any of the measured is greater than the rated value by more than 10%, two more tests are required. In such a case, for each individual test the values shall not be greater than the rated values by more than 10 %.
- Also, the information on the energy label shall be based on the higher values (lower efficiency)

## ***6.6. Assessment of energy efficiency labels in the countries referred***

To develop and implement the Standards and Labelling Programme in the Maldives, it is essential to analyse the energy efficiency labels of the countries that are the major importers for the Maldives. The key aspects of the energy labels in those countries, the design of the energy labels and the details it entails shall form a basis on which the energy efficiency labelling for the Maldives can be drafted.

This analysis is done keeping in focus the comparative labels that are prevalent in the countries that are the major importers of air conditioners, refrigerators and washing machine for the Maldives.

### ***6.6.1. Key aspects under design of label***

The energy efficiency label of a particular country is drafted keeping in mind certain factors such as consumer awareness, ease of consumers to understand the label, size of the market and acceptability of the energy label across different manufacturers and importers.

The energy efficiency comparative labels are the labels attached to energy consuming products, which help to **describe product's** energy performance level, and inform about the energy efficiency performance to customers industries and governments, **using either discrete categories of performance or a continuous scale**. The comparative labels can help the customers to make wise decisions to choose high energy-efficiency products, and encourage the industries to optimize the product performance on energy-efficiency.

The analysis of the comparative labels of the major importers for the Maldives is done keeping in mind two kinds of parameters: technical parameters and aesthetic parameters.

Technical parameters focus on the technical aspects covered in the energy efficiency label, such as the label contents and the parameter against which the label has been graded. These parameters are derived based upon certain testing standards applicable for a particular appliance of a particular country, or the international standards as prescribed by the ISO or IEC.

Aesthetic details cover the design aspects of the label, such as the label ticker, label dimensions, colour code (C, M, Y, K) format, label position on the appliance, fonts and languages used etc.

These parameters vary from appliance to appliance, and also from one country to another.

### **6.6.2. Label details for air conditioners in the countries referred**

This analysis covers the label details for air conditioners in the countries that are major importers to the Maldives.

The technical parameters are tabularised as follows:

*Table 61: Summary of technical contents on labelling programs for air conditioners in different countries*

Countries	Technical Parameters	
	Label Content	Graded Parameter
China	<ul style="list-style-type: none"> <li>EER/SEER/APF</li> <li>Cooling capacity</li> <li>Power output</li> </ul>	<ul style="list-style-type: none"> <li>Energy Efficiency</li> </ul>
Thailand	<ul style="list-style-type: none"> <li>AC type – fixed speed/ inverter type</li> <li>EER/SEER</li> <li>General details</li> </ul>	<ul style="list-style-type: none"> <li>Energy Efficiency Ratio (EER) for fixed speed air conditioners</li> <li>Seasonal Energy Efficiency Ratio (SEER) for variable speed air conditioners</li> </ul>
Singapore	<ul style="list-style-type: none"> <li>Annual Energy Cost<sup>39</sup></li> <li>Annual energy consumption</li> <li>Brand name, Model, Type, Size</li> <li>Test Standards</li> <li>Registration Number</li> </ul>	<ul style="list-style-type: none"> <li>COP 100% value (W/W) for fixed speed type</li> <li>Weighted COP for variable speed type</li> </ul>
Malaysia	<ul style="list-style-type: none"> <li>Average energy consumption per year</li> <li>Appliance type</li> <li>Brand and model</li> </ul>	<ul style="list-style-type: none"> <li>Energy Efficiency Ratio (EER) for fixed speed air conditioners</li> <li>Adjusted EER for variable speed air conditioners</li> </ul>
India	<ul style="list-style-type: none"> <li>Star Label</li> <li>Electricity Consumption</li> <li>Label Period</li> <li>Appliance/Type</li> <li>Model/Year</li> <li>Type</li> <li>Gross Volume</li> <li>Storage Volume</li> </ul>	<ul style="list-style-type: none"> <li>Energy Efficiency Ratio (EER)</li> <li>Indian Seasonal Energy Efficiency Ratio (ISEER)</li> </ul>

<sup>39</sup> Based on 27 cents per kWh electricity cost, 8 hours daily usage and 16 hours standby energy consumption

	<ul style="list-style-type: none"> <li>• BEE Logo</li> <li>• Disclaimer for calculation of electricity consumption</li> </ul>	
Hong Kong	<ul style="list-style-type: none"> <li>• Annual energy consumption (kWh/year)</li> <li>• Cooling capacity (kW)</li> <li>• Refrigerant used</li> <li>• Model number, brand details etc.</li> </ul>	<ul style="list-style-type: none"> <li>• Cooling Seasonal Performance Factor (CSPF)</li> </ul>

The aesthetic parameters are charted as follows:

**Table 62: Summary of aesthetic details of labels in different countries**

Countries	Aesthetic Parameters					
	Label Ticker	Size (dimensions in cm)	Color Scheme CMYK format	Label Position	Font	Label Language
China	Grade/ Number: 1 (best) to 5 (worst)	Width: 6. Height: 11	(100, 33, 0, 19) (25, 0, 31, 50) (35, 0, 34, 23) (0, 4, 100, 0) (0, 48, 89, 9) (0, 83, 87, 15) (0, 0, 0, 30) (0, 0, 0, 100)	Top right corner	Chinese	Chinese
Thailand	Grade/ Number: 1 (worst) to 5 (best)		(0, 4, 78, 5) (0, 75, 75, 27) (4, 0, 76, 29) (50, 0, 50, 53) (0, 0, 0, 100) (0, 0, 0, 0)	Top right corner	Thai	Thai
Singapore	Ticks: 1 (worst) to 5 (best)	Width: 9 Height: 9 Diameter of Arc: 9		Top right corner	Arial: Bold Black	English
Malaysia	Stars: 1 (Worst) to 5 (Best)	Width: 8 Height: 12 Diameter of Arc: 8	(6,89,75,1) (1,5,91,0) (32,22,17,4) (0,0,0,100)	Top right corner	Myriad Pro: Bold/Italic/Regular Black	Malay English
India	Stars: 1 (Worst) to 5 (Best)	Width: 6.3 Height: 11.8 Diameter of Arc: 6.3	(0,100,100,0) (0,0,0,100) (0,0,100,0) (97,95,6,1)	Top right corner	Arial: Narrow/ bold Black	English

			(81,10,90,1)			
Hong Kong	Grade/ Number: 1 (best) to 5 (worst)	Width: 10.6 Length: 15.6	(0,100,100,0) (0,0,0,100) (80,0,100,15) (45,0,100,0) (0,15,100,0) (0,16,100,0) (0,100,100,15) (0,0,20,0) (5,100,90,0) (40,0,70,0) (0,10,10,0) (0,0,0,0)		Helvetica Neue Bold Helvetica Roman Futura Bold Condensed DFHei Medium Kabel Ult BT Monotype Yuen	English Chinese

### 6.6.3. Label details for refrigerators in the countries referred

This analysis covers the label details for refrigerators in the countries that are major importers to the Maldives.

The technical parameters are tabularised as follows:

*Table 63: Summary of technical contents on labelling programs for refrigerators in different countries*

Countries	Technical Parameters	
	Label Content	Graded Parameter
China	<ul style="list-style-type: none"> <li>Product Manufacturer</li> <li>Product Model Number</li> <li>Level</li> <li>Energy Consumption</li> <li>Energy Efficiency</li> </ul>	Annual Energy (E) (kWh/year)
Thailand	<ul style="list-style-type: none"> <li>Grade (in no.) as per the label</li> <li>Year of certification criteria</li> <li>Type of appliance</li> <li>Energy consumption (kWh/year)</li> <li>Electricity cost (Baht/year)</li> <li>Energy efficiency ratio</li> <li>Product Details like model number, model name, brand name</li> </ul>	<ul style="list-style-type: none"> <li>Annual Energy Consumption (Ec) (kWh/year)</li> </ul>
Singapore	<ul style="list-style-type: none"> <li>Energy efficiency rating</li> <li>Ticks</li> <li>Annual energy cost</li> <li>Annual energy consumption</li> <li>Brand Name</li> <li>Model Number</li> <li>Type of Refrigerator</li> <li>Total Storage Volume (L)</li> <li>Test Standard</li> </ul>	<ul style="list-style-type: none"> <li>Annual Energy Consumption (AEC) (kWh/year)</li> </ul>

	<ul style="list-style-type: none"> <li>Disclaimer</li> <li>Registration Number</li> </ul>	
Malaysia	<ul style="list-style-type: none"> <li>Energy rating in stars</li> <li>Appliance Type</li> <li>Appliance Energy Rating</li> <li>Brand and model information</li> <li>Energy Consumption</li> <li>Energy savings compared to lowest 2 star rated product</li> <li>Testing standards used at lab conditions</li> </ul>	<ul style="list-style-type: none"> <li>Average Energy Consumption per year (kWh/year)</li> </ul>
India	<ul style="list-style-type: none"> <li>Star Label</li> <li>Electricity Consumption</li> <li>Label Period</li> <li>Appliance/Type</li> <li>Model/Year</li> <li>Type</li> <li>Gross Volume</li> <li>Storage Volume</li> <li>BEE Logo</li> <li>Disclaimer for calculation of electricity consumption</li> </ul>	<ul style="list-style-type: none"> <li>Annual Energy Consumption (AEC) (kWh/year)</li> </ul>

The aesthetic parameters are charted as follows:

*Table 64: Summary of aesthetic parameters on labels in different countries*

Countries	Aesthetic Parameters					
	Label Ticker	Size (dimensions in cm)	Color Scheme CMYK format	Label Position	Font	Label Language
China	Grade/ Number: 1 (best) to 5 (worst)	Width: 6. Height: 11	(100, 33, 0, 19) (25, 0, 31, 50) (35, 0, 34, 23) (0, 4, 100, 0) (0, 48, 89, 9) (0, 83, 87, 15) (0, 0, 0, 30) (0, 0, 0, 100)	Top right corner	Chinese	Chinese
Thailand	Grade/ Number: 1 (worst) to 5 (best)		(0, 4, 78, 5) (0, 75, 75, 27) (4, 0, 76, 29) (50, 0, 50, 53) (0, 0, 0, 100)	Top right corner	Thai	Thai

			(0, 0, 0, 0)			
Singapore	Ticks: 1 (worst) to 5 (best)	Width: 9 Height: 9 Diameter of Arc: 9	(44, 0, 69, 40) (0, 4, 41, 0) (0, 6, 85, 0) (0, 0, 0, 100) (0, 0, 0, 100)	Top right corner	Arial: Bold Black	English
Malaysia	Stars: 1 (Worst) to 5 (Best)	Width: 8 Height: 12 Diameter of Arc: 8	(6,89,75,1) (1,5,91,0) (32,22,17,4) (0,0,0,100)	Top right corner	Myriad Pro: Bold/Italic/Regular Black	Malay, English
India	Stars: 1 (Worst) to 5 (Best)	Width: 6.3 Height: 11.8 Diameter of Arc: 6.3	(0,100,100,0) (0,0,0,100) (0,0,100,0) (97,95,6,1) (81,10,90,1)	Top right corner	Arial: Narrow/ bold Black	English

#### 6.6.4. Label details for washing machine in the countries referred

This analysis covers the label details for washing machines in the countries that are major importers to the Maldives.

The technical parameters are tabularised as follows:

*Table 65: Summary of technical contents on labelling programs for washing machines in different countries*

Countries	Technical Parameters	
	Label Content	Graded Parameter
China	<ul style="list-style-type: none"> <li>Energy Consumption per cycle</li> <li>Water consumption per cycle</li> <li>Washing Effectiveness</li> <li>Rated wash capacities</li> </ul>	<ul style="list-style-type: none"> <li>Energy Efficiency</li> <li>Water efficiency</li> <li>Wash performance</li> </ul>
Thailand	Not applicable	Not applicable
Singapore	<ul style="list-style-type: none"> <li>Tick Marks</li> <li>Model</li> <li>Brand</li> <li>Registration Number</li> </ul>	<ul style="list-style-type: none"> <li>Water Factor</li> </ul>
Hong Kong	<ul style="list-style-type: none"> <li>Annual energy consumption (kWh/year)</li> <li>Wash capacity</li> <li>Water consumption</li> <li>Model number, brand details etc.</li> </ul>	<ul style="list-style-type: none"> <li>Energy Efficiency</li> </ul>
UAE	<ul style="list-style-type: none"> <li>Annual energy consumption (KWh/year)</li> <li>Annual water consumption (L/year)</li> </ul>	<ul style="list-style-type: none"> <li>Energy efficiency</li> <li>Spin drying efficiency</li> </ul>

	<ul style="list-style-type: none"> <li>• Capacity (kg)</li> <li>• Brand name, model number etc.</li> <li>• Disclaimer for calculation of electricity consumption</li> </ul>	
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The aesthetic parameters are tabularised as follows:

**Table 66: Summary of aesthetic contents on labels in different countries**

Countries	Aesthetic Parameters					
	Label Ticker	Size (dimensions in cm)	Color Scheme CMYK format	Label Position	Font	Label Language
China	Grade/ Number: 1 (best) to 5 (worst)	Width: 6. Height: 11	(100, 33, 0, 19) (25, 0, 31, 50) (35, 0, 34, 23) (0, 4, 100, 0) (0, 48, 89, 9) (0, 83, 87, 15) (0, 0, 0, 30) (0, 0, 0, 100)	Top right corner of front face	Chinese	Chinese
Thailand	Grade/ Number: 1 (worst) to 5 (best)		(0, 4, 78, 5) (0, 75, 75, 27) (4, 0, 76, 29) (50, 0, 50, 53) (0, 0, 0, 100) (0, 0, 0, 0)	Top right corner of front face	Thai	Thai
Singapore	Ticks: 1 (worst) to 5 (best)	Height: 14 Diameter of Arc: 11	(51,0,9,10) (100,100,0,40)	Top right corner of front face	Arial: Bold Black	English
Hong Kong	Grade/ Number: 1 (best) to 5 (worst)	Width: 10.6 Length: 15.6	(0,100,100,0) (0,0,0,100) (80,0,100,15) (45,0,100,0) (0,15,100,0) (0,60,100,0) (0,100,100,15) (0,0,20,0) (5,100,90,0) (40,0,70,0) (0,10,10,0) (0,0,0,0)	Top right corner of front face	Helvetica Neue Bold Helvetica Roman Futura Bold Condensed DFHei Medium Kabel Ult BT Monotype Yuen	English, Chinese

UAE	Stars: 1 (Worst) to 5 (Best)	Width: 16.7 Length: 8.8	(0,0,0,100) (0,100,100,0) (90,7, 95, 0) (82,7, 95, 0) (50,0,100,0) (4, 0, 95,0) (0, 35, 84,0) (0, 100, 100, 0)	Top right corner of front face		Arabic, English
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## 6.7. Brief overview of the climate conditions in countries referred

Table 67: Overview of climatic conditions in different countries

	Temperature	Rainfall	Humidity	Climatic Zones
<b>Maldives<sup>40</sup></b>	Average consistent temperature of 30 °C	Approximately 250 cm annual rainfall	75% humidity, especially during parts of the dry season	Tropical climate, hot all year round and influenced by the monsoons
<b>China<sup>41</sup></b>	20°C-23°C, but varies drastically with the landforms	200 cm, but is less in cold deserts like Tibet	56.5%, varies with the terrain and climatic conditions.	<ul style="list-style-type: none"> <li>• Cold Temperate climatic zone.</li> <li>• Mid Temperate climatic zone.</li> <li>• Warm Temperate climatic zone.</li> <li>• Subtropical climatic zone.</li> </ul>
<b>Singapore<sup>42</sup></b>	23°C-33°C, due to small land area and tropical climate	216.59 cm due to high humidity and constant temperature.	83.9% due to falling in the tropical wet zone	Tropical wet and dry climatic zone
<b>Malaysia<sup>43</sup></b>	23°C-28°C due to small land area and tropical climatic conditions	254 cm due to high relative humidity and constant temperature	86% due to tropical wet climatic conditions	Tropical wet climatic zone

<sup>40</sup> Source: <https://www.climatestotravel.com/climate/maldives> as retrieved on 6th March 2018.

<sup>41</sup> Source: <https://www.travelchinaguide.com/climate/> as retrieved on 6th March 2018.

<sup>42</sup> Source: <http://www.weather.gov.sg> as retrieved on 6th March 2018.

<sup>43</sup> Source: <http://www.holiday-weather.com/country/malaysia/> as retrieved on 6th March 2018.



<b>Thailand</b> <sup>44</sup>	26°C-31°C. Average climate throughout the year	150 cm (59 in) due to high humidity and tropical climate throughout the year	78% due to tropical wet weather	Tropical wet and dry climatic zone
<b>India</b> <sup>45</sup>	32°C-40°C. Varies drastically with changing landforms	65 cm. Varies from no or less rainfall of 0-30 cm to high rainfall areas 1180 cm.	40% - 70%. Depends on the terrains like desert, plateau, coastal areas or mountains.	<ul style="list-style-type: none"> <li>• Arid desert in the west</li> <li>• Alpine tundra and glaciers in the north</li> <li>• Humid tropical regions in southwest and northeast</li> <li>• Rainforests in the southwest</li> <li>• The island territories.</li> </ul>
<b>Hong Kong</b> <sup>46</sup>	An average annual temperature of 23 °C.	The mean annual rainfall ranges from about 1400 mm to more than 3000 mm, depending on the area	Approximately 75% on average	Sub-tropical, tending towards temperate for nearly half the year
<b>UAE</b> <sup>47</sup>	The temperature ranges from 14 °C to 50 °C	The average annual rainfall in the coastal area is <b>fewer than 120 mm</b>	85% to 90% in coastal areas	Desert climate

<sup>44</sup> Source: <http://www.plantsrescue.com/the-12-climate-regions/> as retrieved on 6<sup>th</sup> March 2018.

<sup>45</sup> Source: <https://www.currentresults.com/Weather/India/> as retrieved on 6<sup>th</sup> march 2018.

<sup>46</sup> Source: [http://www.weather.gov.hk/cis/climahk\\_e.htm](http://www.weather.gov.hk/cis/climahk_e.htm) as retrieved on 6<sup>th</sup> March 2018.

<sup>47</sup> Source: <https://www.climatestotravel.com/climate/united-arab-emirates> as retrieved on 6<sup>th</sup> March 2018.

# 7. International case studies and approaches for developing programme for Maldives

## 7.1. Programme developed in Brunei

### Country basics<sup>48</sup>

Brunei, officially the Nation of Brunei, is a small sovereign state located on the north coast of the island of Borneo in Southeast Asia. The country is completely surrounded by the Malaysian state of Sarawak. Brunei's population stood at 423,196 in 2016. The major languages of Brunei are Malay and English.

Brunei's small, wealthy economy is a mixture of foreign and domestic entrepreneurship, government regulation, welfare measures, and village tradition. Crude oil and natural gas production account for about 90% of its GDP.<sup>49</sup>



Figure 9: Map of Brunei

### The climate of Brunei is tropical equatorial.

### Energy use & need for S&L

Brunei, like other South East Asian developed countries, is a heavy consumer of energy. In fact, the country is placed as one of the countries in Asia to have the highest energy intensity per capita. Concerned with the rising burden of subsidies for energy use and detrimental effects of climate change, Brunei's Energy Department in Prime Minister's Office (EDPMO) decided to **implement energy efficiency standards and labelling programs for two of its highest energy consuming appliances: air conditioners and lighting.**

It was assessed that stringent policy measures, just like those in other countries, need to be established, along with incentives and enforcement capacity, in order to make the standards robust and viable over the long years. **A study was conducted by BNERI in 2013/2014 to establish S&L programs for air conditioners in the country.**

The study highlighted programs of 3 countries, based on which the S&L program for Brunei was developed.

### International programs considered

To develop the S&L program in Brunei, **labelling programs in three major countries were chosen as the base case – Singapore, Malaysia, and Australia.** Singapore and Malaysia were selected due to their Geographical proximity and relevance, as they represent the local conditions and major market, whereas Australia was considered to gain an international perspective.

The study discusses the development and best practices of the schemes in each country and explores recommendations for Brunei in terms of its rating for air conditioners' performances and design of the energy rating label.

<sup>48</sup> Source: Public information

<sup>49</sup> Source: BNERI, "Comparative Study On Energy Efficiency Ratings And Labelling For Air-Conditioners: Proposal For Brunei", 2012

## Determination of MEPS values in Brunei

To determine the appropriate value of MEPS for air conditioners sold in Brunei, various options for MEPS were considered during interactions among major stakeholders such as EDPMO, Attorney General Chambers (AGC), vendors and other government agencies. The range of MEPS value for EER considered was from 2.7 to 3.34.

The modelling platform used is Policy Analysis Modelling Scheme (PAMS), developed by CLASP which calculated the life cycle costs and benefits of the options through two related perspectives: consumer perspective and national perspective. Based on the results of the analysis, a MEPS value of 2.9 EER was considered to be best option. **Despite highly subsidized electricity prices, savings would significantly be realized using this MEPS value.**

The MEPS of 2.9 is imposed on residential air conditioner, which is recommended under the proposed Standard and Labelling Order. **In line with the proposed ASEAN harmonization on MEPS, the performance metric to be adopted by Brunei is EER rather than COP. The unit for this metric is in Watts/Watts (W/W).**

## Design of standard & labelling scheme for air conditioners

As Brunei's market and climatic conditions are closely aligned with those of Malaysia, Singapore and Australia's standards of calculating the energy efficiency ratings. Therefore, **it is recommended to maintain a star rating based label in Brunei to maintain harmonization of the energy efficiency labels.** Over the next few years, the MEPS could be raised by assigning the next highest star.

However, any improvement or increase in MEPS will be reviewed on a regular basis considering the trend in the penetration and use of more efficient air-conditioners both regionally and globally.

**Label design:** Similar to the 3 programs considered, Brunei's label is a rectangular-shaped size with dimensions of 9 cm (width) by 13 cm (length), with round edges. The colors being utilized reflect the national flag of Brunei, which comprises yellow, black, white and red.

**Language:** The label utilizes Malay and English languages, since the official languages of Brunei are Malay and English. As Malay language is more predominant than English, the font size of the former would be larger than the latter.

**Where to fix:** In line with Singapore's standard of label affixing, the labels shall be properly affixed on air-conditioners (and other registered products) and displayed in stores. The reason for this is to allow such products to be visually inspected by the Authority to assess compliance with labelling programs, and also to collect information on stocking practices.





## Proposed test standard

Similar to Singapore, Brunei would follow two kinds of standards: **ISO 5151:2010 and ISO 15042:2011**, which are applicable for non-inverter and inverter air-conditioners respectively. **This is in line with the CLASP's ASEAN Harmonisation of test methods which identify ISO 5151:2010 as the benchmark test standard.**

## Summary

Table 68: Summary

	Singapore	Malaysia	Australia	Brunei (proposed)
MEPS	3.34 (COP)	9.00 (EER)	2.75 (EER)	2.9 (EER)
Type of Rating	Tick	Star	Star	Star

<b>Rating Band</b>	Between 1 tick (lowest) and 5 ticks (highest)  <i>Increment of 1 tick</i>	Between 1 star (lowest) and 5 stars (highest)  <i>Increment of 1 star</i>	Between 1 star (lowest) and 6 stars (highest)  <i>Increment of 0.5 stars</i>	Between 1 star (lowest) and 5 stars (highest)  <i>Increment of 1 star</i>
<b>Label Design</b>				
<b>Label Dimension</b>	9 cm (width), 9 cm (height)	9 cm (width), 13.5 cm (height)	Not specified	9 cm (width), 13 cm (height)
<b>Label Language</b>	English	Malay and English	English	Malay and English
<b>Test Standards</b>	ISO 5151:2010, ISO 15042:2011, IEC 62301:2005 or IEC 62301:2011	MS ISO 5151: 2004	AS/NZS3823	ISO 5151:2010, ISO 15042:2011

## 7.2. Programme developed in Fiji

### Country background

Fiji, officially the Republic of Fiji, is an island country in Melanesia in the South Pacific Ocean about 2,000 km northeast of New Zealand's North Island. Fiji is an archipelago of more than 330 islands, of which 110 are permanently inhabited, and more than 500 islets, amounting to a total land area of about 18,300 square kilometres. The two major islands, Viti Levu and Vanua Levu, account for 87% of the total population of 898,760.<sup>50</sup>

**The climate in Fiji is tropical marine and warm year round with minimal extremes.**

### Background of S&L program<sup>51</sup>

In 2009, during the meeting among leaders of the Pacific Island Forum, the urgency in improving energy efficiency and conservation to reduce the high burden caused by fossil fuel dependency was highlighted. Subsequently, in 2011, the Leaders emphasised the importance of meeting energy efficiency targets, including expanding the existing electrical appliance energy efficiency standards and labelling programme as a means to achieving energy savings in PICTs.



Figure 10: Map of Fiji

<sup>50</sup> Source: Public information

<sup>51</sup> Source: [https://www.iea.org/media/workshops/2015/egrdoct/11Farrell\\_DTU.pdf](https://www.iea.org/media/workshops/2015/egrdoct/11Farrell_DTU.pdf), retrieved on 23 February 2018

In order to develop an S&L program in Fiji, under the aegis of the PALS scheme, a Technical Analysis of Appliance Markets was conducted to Support the Pacific Appliance Labelling and Standards (PALS) Programme in 2012.

The objective of the study was to analyse the characteristics of major appliance and lighting products and markets in Fiji, in order to inform and support decision making on the most effective Standards & Labelling (S&L) strategy for Fiji.

### Results of market study in Fiji<sup>52</sup>

Based on the analysis of the electrical appliances customs data for the period of 2006 to 2010 and the wholesaler and retailer shop surveys conducted from April to July 2012, **the large majority of the electrical appliances** imported into Fiji, particularly high energy consuming appliances such as refrigerators, freezers and air conditioners are **sourced from Australia and New Zealand**. The detailed breakup is shown below:

*Table 69: Summary of market study in Fiji*

Electrical appliance	% with Energy Labels	Types of Energy label
<b>Air conditioners</b>	75 – 100%	Majority had Singaporean Energy Label. All LG Air conditioners has Singaporean Energy Label <10% of air conditioners with Aus/NZ label
<b>Domestic Washing Machines</b>	50%	Of those with energy labels, 70% to 80% had Aus/NZ energy label. 25% to 60% of Akira appliances had China label All LG washing machines has Singaporean Energy Label
<b>Freezers</b>	76 – 100%	80% to 95% had Aus/NZ energy label.
<b>Refrigerators</b>	76 – 100%	80% to 95% had Aus/NZ energy label.
<b>Televisions</b>	51 – 75%	Hisense branded televisions had Aus/NZ energy labels Akira appliances had China label All LG televisions has Singaporean Energy Label

### Design of S&L program in Fiji<sup>53</sup>

Given the results of the market study, geographical proximity, and similarity of climate conditions with those in Australia and New Zealand, Fiji decided to adopt its **MEPSL – Minimum Energy Performance Standards and Labelling** program on the basis of the S&L program in Australia/New Zealand.

If an electrical appliance is under the Fiji MEPSL programme, then it is mandatory for the importer (individual or retailer) to comply with the regulation(s) and to seek prior permit/approval from the Department of Energy (DoE) before any importation.

Importers are required to ensure that every appliance imported into Fiji is attached with the AS/NZS label and complies with the relevant standard. Importers must get the appliance registered with Fiji/Australia/New Zealand regulatory agencies by following the steps provided in this link: <http://www.energyrating.gov.au/for-industry/product-registration/>.

If found non-compliant, the non-compliant appliance to the country of origin or any other country of the importer's choice at the importer's cost.

<sup>52</sup> Source: Renewable Energy & Energy Efficiency Partnership (REEEP), "Technical Analysis of Appliance Markets to Support The Pacific Appliance Labelling and Standards (PALS) Programme", 2012

<sup>53</sup> Source: MEPSL FAQ

## Implementation

The Department of Energy, Government of Fiji has developed a dedicated section on its website to support in effective administration of the MEPSL scheme. Here, details of the scheme such as background, introduction, FAQs, administration procedures, test standard followed are provided in detail for the benefit of importers.

The site can be reached at: <http://www.fdoe.gov.fj/index.php/energy-security/energy-conservation-efficiency/meps/>

## 7.3. Approaches for developing EE labelling programme in Maldives

The two case studies discussed above involve countries whose markets are generally dependent on imports from other countries. Brunei's market is dependent on imports from Malaysia and Singapore, whereas Fiji's is almost entirely dependent on Australia and New Zealand.

Consequently, **Brunei has developed its own energy efficiency labelling program based on programs of other countries, Fiji has decided to directly adopt the AS/NZS labelling program.** Therefore, the overall implementation process, the level of control of local government on the program, and the impact on imports are significantly different in the two countries.

These case studies show that the **degree of adoption of international programs can have a significant impact on the labelling program in the Maldives.** Based on the local conditions of the Maldivian market, existing infrastructure for execution, and current plans of the government/stakeholders, an appropriate decision on the level of adoption of international programs must be taken.

The two approaches identified include:

- **Direct adoption** – In this approach, the labelling program of one country would directly be adopted in the Maldives, like in the case of Fiji.
- **Customisation** – In this approach, a separate customised label would be developed for the Maldives.

**Both the approaches have their pros and cons.** The various aspects of each approach are discussed in the following table. A rating method has been used. The nomenclature is shared below:

Rating	Meaning
●●●	Highly preferable
●●●	Reasonably preferable
●●●	Low preference
●●●	Undesirable

Table 70: Assessment of approaches for development of labelling program in the Maldives

Parameter	Direct adoption	Customisation
Relevance to the Maldives context	●●● Direct adoption of any international programme is usually proposed after reviewing the similarities between the countries /conditions. Though, any other country's programme might not be completely aligned with the local context	●●● (high) A program specifically designed for the Maldives will be highly relevant to the local context such as aligning the technical performance of appliances with programme design

	of Maldives but in larger perspective direct adoption can be the way forward considering its relevance.	
Degree of bias involved	<p>●●●</p> <p>In case of Maldives, adoption of an international programme will pose requirements on importers for obtaining necessary appliance-specific details for the labelling programme.</p> <p>The traders, manufacturers based in the country of the selected /adopted program is adopted are likely to have an advantage. However, this scenario might exist only for a short time as S&amp;L programmes are now known worldwide and traders can adapt to the necessary changes within no time.</p>	<p>●●●</p> <p>With a programme designed for Maldives, the bias involved will be minimum. However, some bias may creep in, based on the international test procedures adopted. However, as discussed this scenario might exist only for a short time.</p>
Understanding with manufacturers of appliances	<p>●●● (high)</p> <p>Since the labelling programme is developed based on a adopted programme from another country, the overall methodology is already proven and the manufacturers have the completed details available with them so as to be able to produce the products as per the requirements of programme</p>	<p>●●●</p> <p>In case of customisation, if the programme methodology is decided to be different than those being referred in countries from where the products are shipped and manufactured at present then there can be concerns with the oversees manufacturers to be able to produce products with performance metric specifically designed as per Maldivian programme.</p>
Need for test infrastructure & logistics constraints for M&V	<p>●●● (high)</p> <p>Monitoring and verification requirements by MEA would be based upon qualification of products in internationally recognised laboratories where the products are already getting tested for the established programmes. Such test agencies can be identified. Also, the importers can be informed for submitting the qualification details /test reports from the identified laboratories.</p>	<p>●●●</p> <p>In case of customisation also, internationally accepted test standards will be referred. However, the MEA might need to coordinate extensively with international test agencies to explain them the requirements as per locally designed programme. The programme will expect development of in-house test infrastructure in the country.</p>
Effective timeline for implementation	<p>●●● (high)</p> <p>Direct adoption will only involve aspects such as roll out of regulation, implementation procedure and MOU with the authorities of reference programme. This approach can facilitate implementation is much lesser time.</p>	<p>●●●</p> <p>This approach will involve slow and steady process with capturing details such as technical performance of appliances locally available, discussion between stakeholders for baseline setting and deciding on the label bands, sensitization of all stakeholders etc.</p>
Program acceptability by stakeholders	<p>●●●</p>	<p>●●●</p> <p>Since a program specific to the Maldives is designed, the program will be more</p>

	As the reference program will ideally be well established, program acceptability is expected to be high	suitable to the local context. Therefore, this may be more impactful to the consumers
Flexibility	<p>●●●</p> <p>As the program is directly adopted, there is little flexibility for MEA to modify the program in the future as the expectations will be keep it aligned with international programme. However, minor changes can be easily brought-up under the programme.</p>	<p>●●● (high)</p> <p>As the program is designed by MEE, the program can be modified at will be MEE, should the need arise in the future</p>

### Way forward for the Maldives

Based on the above assessment, a labelling programme for the Maldives, which is developed based on adoption of parameters from the programme developed in other country seems preferable. However, given our assessment of the local context, we believe that the customised programme could be also possible in Maldives given there is sufficient timeframe available for development process, stakeholders are ready to obtain data on performance of appliances as per international test procedures from international manufacturers, and financial investments are made for third party testing (as per the requirement).

In the present scenario, best way forward for the labelling programme in Maldives is to adopt the test standards, practices including the labelling criteria and label band etc. from international programs and design the label based on the local context. A few minor changes can be brought under the adoption approach as well depending upon the consensus between the stakeholders of the programme.

**The program design for individual appliances are shown in subsequent chapters.**



# 8. Proposed EE labelling program for air conditioners in the Maldives

## 8.1. Assessment based on key indicators and identifying the proposal for labelling programme

Based on the detailed findings presented in previous chapters, an evaluation matrix is developed to help make decisions to propose the most relevant way forward for standard & labelling programme for air conditioners in the Maldives. Based on the information captured against each parameter a rating has been given. Three point rating method has been used. The nomenclature is shared below:

Rating	Meaning
Z	Neutral parameter
H	High relevance
M	Medium relevance
L	Low relevance

The approach followed for the assessment is as follows:

- Step 1: Firstly, programs most relevant to the context in Maldives are identified on the basis of **similarity of the scope of the labelling programme with the market characteristics in the Maldives, and homogeneity of climate conditions.**
- Step 2: The shortlisted programs are then assessed on the basis of **test standards followed, tests prescribed, and parameters used for determination of performance** & label grade.
- Step 3: Once the most relevant program(s) are identified across these parameters, further assessment on factors such as eligibility criteria and other aspects is conducted to **identify the most appropriate program to be adopted in the Maldives.**

**After finalization of the program to be adopted, a framework for the labelling programme in the Maldives is proposed, followed by the proposed label contents.**

## Step 1: Assessment of scope of identified programs

Table 71: Country specific programme scope for air conditioners and climate conditions<sup>54</sup>

Parameters		Scenario in Maldives	China	Singapore	Malaysia	Thailand	India	Hong Kong
Scope		The majority of the market seems to be comprised of <b>variable speed split type air conditioners</b> , with capacities ranging from 9000 Btu/hr to 24000 Btu/hr	All residential air conditioners capacities upto 14 kW [ <b>47780 Btu/hr</b> ]. Both fixed speed and variable speed ACs are included.  Limits are both variable & fixed speed ACs based on capacity: <ul style="list-style-type: none"> <li>Upto 4.5 kW [<b>15355 Btu/hr</b>]</li> <li>4.5 kW to 7.1 kW [<b>25000 Btu/hr</b>]</li> <li>More than 7.5 kW</li> </ul>	All Single-phase non-ducted room air-conditioners having a cooling capacity of: <ul style="list-style-type: none"> <li>8.8 kW [<b>30,000 Btu/hr</b>] or lower, for casement or window type air-conditioner;</li> <li>17.6 kW [<b>60,000 Btu/hr</b>] or lower, for split type (inverter) air-conditioner; or</li> <li>17.6 kW [<b>60,000 Btu/hr</b>] or lower, for split type (non-inverter) air-conditioner</li> </ul>	Single split wall mounted air conditioners with a capacity up to 7.1 kW [ <b>25000 Btu/h</b> ]. Both fixed speed & variable speed ACs are included.  Limits as based on capacity of air conditioners: <ul style="list-style-type: none"> <li>Upto 4.5 kW [<b>15355 Btu/hr</b>]</li> <li>4.5 kW to 7.1 kW [<b>25000 Btu/hr</b>]</li> </ul>	All types of air conditioners with a net cooling capacity upto 12 kW [ <b>41,000 Btu/hr</b> ]  However, separate limits are prescribed based on capacity: <ul style="list-style-type: none"> <li>Upto 27296 Btu/Hr</li> <li>More than 27296 Btu/Hr</li> </ul>	Fixed speed air conditioners with a cooling capacity of upto 11 kW [ <b>37533 Btu/hr</b> ]  Variable speed air conditioners of cooling capacities upto 9000 kCal/hr [ <b>35961 Btu/hr</b> ]	All room air conditioners <b>having a rated cooling capacity upto 7.5 kW [25591 Btu/hr]</b>
	Rating		H	M	H	H	M	H
Climate conditions		The Maldives has a tropical monsoon climate, with average temperature around 30 degrees Celsius during the whole year	Mixed climate.	Uniform temperature and pressure, high humidity and abundant rainfall.  <b>The average temperature lies between 25 and 31 degrees Celsius</b>	Equatorial climate, being hot and humid throughout the year. The average rainfall is 250 centimeters a year and <b>the average temperature is 27 °C</b>	Tropical climate with a <b>mean annual temperature of 27°C</b> and high humidity.	Mixed climate.	The city has an average annual temperature of 23 °C.
	Rating		L	H	H	H	L	M

From the above table, it can be assessed that all the programs considered in the assessment capture most of the market in the Maldives in their scope. This makes all programs relevant to the analysis on the basis of scope. However, as India and China have significantly different climate from the Maldives, the relevance of their programs are reduced. Therefore, **programs of Singapore, Malaysia, Thailand and Hong Kong are shortlisted for further assessment.**

<sup>54</sup> The table captures information on scope of programs in various countries. For ease of understanding the scope in all countries is also mentioned in Btu/hr using the conversion formula.

## Step 2: Assessment of performance parameter for comparative labelling and test standards

Table 72: Country specific parameters graded and test standards referred

Parameters	Scenario in Maldives	Singapore	Malaysia	Thailand	Hong Kong
Parameter graded	To be determined	<ul style="list-style-type: none"> <li>Coefficient of Performance (COP)</li> <li>Weighted COP</li> </ul>	Cooling Seasonal Performance Factor (CSPF)	<ul style="list-style-type: none"> <li>Energy Efficiency Ratio (EER)</li> <li>Seasonal Energy Efficiency Ratio (SEER)</li> </ul>	Cooling Seasonal Performance Factor (CSPF)
Test standard	As Maldives doesn't have localised test standards, globally recognised test standards such as ISO, IEC would be most relevant	<ul style="list-style-type: none"> <li><b>ISO 5151:2010</b> for Casement, window and single-split</li> <li>ISO 15042:2011 for Multi-split</li> <li>IEC 62301:2005 or IEC 62301:2011 for All (for standby power)</li> </ul>	<b>ISO 5151:2010</b>  <b>ISO 16358-1:2013</b>	TIS 2710-2558 or <b>ISO 5151:2010</b>  ISO 16358-1:2013	<b>ISO 5151</b>

All of the shortlisted programs have adopted the ISO standard 5151:2010 as the reference test standard for both fixed speed and variable speed air conditioners. Therefore, it is **recommended that the same test standard & procedure, i.e. ISO 5151:2010 be adopted for the programme in Maldives as well.**

Regarding the parameters describing the performance of air conditioners, **the Energy Efficiency Ratio (EER) or the Coefficient of Performance (COP) is used to determine the performance of fixed speed air conditioners.** However, there are two methods of assessing the performance of variable speed air conditioners – **either by using the Seasonal Energy Efficiency Ratio (SEER),** which accounts for the detailed impact of local climatic conditions, or by **using the adjusted EER or COP,** which takes a weighted average of the EER (or COP) at full capacity and half capacity in the ratio 60:40.

To be able to compute SEER based on local conditions a detailed data is needed on climate conditions of the country, performance of appliance with respect to test protocols considering the local climate conditions etc. This would require testing of air conditioners to generate enough amount of data. In the above programs, most countries were observed to adopt the adjusted EER method for variable speed air conditioners, given the simplicity to its calculation. Therefore, **it is recommended that the programme in Maldives adopt the same approach, i.e. the adjusted EER or COP, as no additional testing or calculation will be required.**

**Overall, the programs in Singapore, Malaysia, and Thailand match the above-mentioned requirements.**

*Since the overall test procedure and parameters for grading have been finalized, aspects such as the label contents and other program details must be finalized. This is done in the following sub-section.*

### Step 30: Assessment of programme parameters and determination of star rating band

The shortlisted programs have been assessed on the basis of their eligibility criteria, to identify the appropriate band range and the parameters to be included in the label contents. The information is presented in the following table:

Table 73: Country specific eligibility criteria and label band range<sup>55</sup>

Parameters	Singapore	Malaysia	Thailand
Eligibility criteria	<p>Adherence to the MEPS requirements</p> <ul style="list-style-type: none"> <li>2.90 COP 100% for casement or window type (upto 8.8 kW)</li> <li>3.78 COP 100% for fixed speed split type</li> <li><b>Weighted COP &gt; 3.78 and COP<sub>100%</sub> &gt; 3.34 for inverter type</b></li> </ul>	<p><b>CSPF = 3.10 Wh/Wh for all air conditioners with capacity &lt; 4.5 kW</b></p> <p><b>CSPF = 2.90 Wh/Wh for all air conditioners with capacity between 4.5 kW and 7.1 kW</b></p>	<p>The programme is under <b>voluntary</b> regime. To be able to sell AC in Thailand the minimum EER should be 2.82 W/W for upto 8 kW capacity (approx. 27300 Btu/hr).</p> <p>For the labelling programme, the minimum EER required is as per No. 3 of EGAT label <b>[10.60 Btu/hr/W or EER 3.1 W/W]</b></p> <p>Additionally, to receive the green label, the following requirements hold:</p> <ul style="list-style-type: none"> <li>Qualify for No. 5 of the EGAT label <b>(11.60 Btu/hr/W [3.4 W/W] ≤ EER for upto 8 kW)</b></li> <li>Adhere to sound requirements</li> <li>Adhere to <b>ODP &amp; GWP</b> requirements</li> <li>Qualify for safety requirements as per TIS 15294 or IEC 60335-2-405 or equivalent</li> </ul>
Label band range	1 Tick (worst) to 5 Ticks (best)	1 star (worst) to 5 star (best)	Label no. 5 (best) to Label no. 3 (worst)

From the above table, in Thailand, the programme is under voluntary labelling regime. The minimum energy efficiency requirement to be able to sell air conditioners in Thailand is less stringent than in Singapore and **Malaysia. Although, for participation in Thailand’s labelling programme the requirements are stringent.** However, since the programme is not mandatory yet it is anticipated that manufacturers are still producing /markets in Thailand would be having the presence of non-labelled air conditioners.

The eligibility requirements in Malaysia are the most **suited to the Maldives’ context on the basis of homogeneity** of climate conditions and scope of the labelling scheme. Also, the S&L programme in Malaysia is mandatory which is eventually reflects the presence of high efficient air conditioners in their markets. Therefore, it is proposed that the label band in Malaysia be adopted for the programme in the Maldives where the market is dominated by variable speed (inverter type) air conditioners. This would eventually facilitate in transformation of market towards high energy efficient air conditioners.

The subsequent section details the proposed labelling framework for air conditioners in Maldives.

<sup>55</sup> For unit conversion purposes, 1 Btu/hr is assumed equivalent to 0.293 W

## 8.2. Proposed energy efficiency labelling programme framework for air conditioners in the Maldives

The section summarises the proposal for S&L programme for air conditioner in the Maldives. The recommendations proposed

Table 74: Proposed energy efficiency labelling program in the Maldives for air conditioners

<b>Scope of the S&amp;L programme</b>	Single-phase single-split and unitary type air conditioners of both fixed speed and variable speed types, for household use including the rated capacities of upto 30000 Btu/hr.		
<b>Referred test standard</b>	ISO 5151:2010, for non-ducted air conditioners and heat pumps – Testing and rating performance Temperature bin distribution shall follow Table 3, ISO 16358-1 IEC 62301:2011, for standby power consumption		
<b>Terms and definitions</b>	<p>As per ISO 5151:2010</p> <ul style="list-style-type: none"> <li>• Cooling Seasonal Performance Factor (CSPF): ratio of total amount of heat the equipment can remove from indoor air when operated for cooling in active mode to the total annual amount of energy consumed by the equipment during the same period. Its unit is Wh/Wh</li> <li>• For fixed speed air conditioners, <math>CSPF = 1.062 \times EER_{tested}</math> at 100% capacity. Energy Efficiency Ratio (EER) is defined as ratio of total cooling capacity to effective power input at any given rating condition. Its unit is kW/kW</li> <li>• For inverter air conditioners, CSPF is calculated using the measured energy consumption during the tests</li> <li>• Standby mode: Lowest power consumption mode which cannot be switched off (influenced) by the user and that may persist for an indefinite time when an appliance is connected to the main electricity supply and used in accordance with the manufacturer's instructions</li> <li>• Standby power: Average power in standby mode when measured in accordance with the specified standard</li> </ul>		
<b>Testing guidelines</b>	As per ISO 5151:2010, ISO 16358-1 and IEC 62301:2011		
<b>Eligibility requirements for minimum coefficient of performance (MEPS)</b>	As per lowest energy efficiency rating level (Level 1)		
<b>Other eligibility requirements (if any)</b>	Refrigerant's ODP & GWP: ODP should be Zero and maximum GWP should be $\leq 700$		
<b>Rating scheme</b>	<b>Rating</b>	<b>For ACs with cooling capacities &lt; 4.5 kW</b>	<b>For ACs with cooling capacities between 4.5 kW and 7.1 kW</b>
		<b>Value of CSPF (Wh/Wh)</b>	<b>Value of CSPF (Wh/Wh)</b>
	<b>Level 1 (lowest)</b>	< 3.10	< 2.90

	<b>Level 2</b>	3.10 – 3.30	2.90 – 3.10
	<b>Level 3</b>	3.30 – 4.60	3.10 – 4.00
	<b>Level 4</b>	4.60 - 5.30	4.00 - 5.10
	<b>Level 5 (highest)</b>	≥5.30	≥5.10

**Other additional requirements that may be covered:**

Some of the international programme considers the following aspects in addition to energy efficiency:

- Sound requirements
- Refrigerant’s ODP and GWP
- Other than the above parameters, programs in China, India & Hong Kong also display the annual energy consumption and annual energy cost/saving as a part of the label.

**It is recommended that stakeholders in the country deliberate whether the additional requirements are suitable to the Maldives’ context.**

**However, it was proposed that the refrigerant’s name, ODP and GWP properties be displayed on the label as an additional requirement.**

A consultative discussion was held within the stakeholders in the Maldives to discuss about the proposed energy efficiency labelling program for air conditioners. **Based on the inputs from stakeholder the proposed energy efficiency program has been updated and it is provided in Appendix B.**

### 8.3. Recommendations on label contents

In the previous subsection, we have proposed that the labelling scheme for air conditioners in Malaysia be adopted for the labelling program in the Maldives. As such, the COP (and the weighted COP) shall be graded from Level 1 to Level 5 on the label.

However, other relevant information, to be displayed separately on the label are identified in this sub-section. We first understand the various parameters displayed on labelling programs of other countries identified in the report:

Table 75: Label contents in various countries' labelling programs

China	Singapore	Malaysia
 <p>The image shows a blue and white energy label from China. It features a scale from 1 to 3, with 1 being the most efficient. The label includes the text '中国能效标识' (China Energy Label) and '能效比' (Energy Efficiency Ratio) with a value of 0.00. It also lists '输入功率 (W)' (Input Power) and '制冷量 (W)' (Cooling Capacity), both with a value of 00000.</p>	 <p>The image shows a semi-circular energy efficiency rating label from Singapore. It has a scale from 1 to 5, with 5 being the highest rating. The label displays 'Annual Energy Cost' as '\$XX' and 'Annual Energy Consumption' as 'XXX kWh'. It also shows 'XXXXX' for both 'EER' and 'SEER'.</p>	 <p>The image shows a red and white energy consumption label from Malaysia. It features a star rating from 1 to 5, with 5 being the highest. The label includes the text 'PENGUNAAN TENAGA' (Energy Consumption) and 'Pergunaan Tenaga Purata Setahun' (Average Energy Consumption Per Year). It also lists 'Appliance type' and 'Brand and model'.</p>
<ul style="list-style-type: none"> <li>EER/SEER/APF</li> <li>Cooling capacity</li> <li>Power output</li> </ul>	<ul style="list-style-type: none"> <li>Annual Energy Cost<sup>56</sup></li> <li>Annual energy consumption</li> <li>Brand name, Model, Type, Size</li> </ul>	<ul style="list-style-type: none"> <li>Average energy consumption per year</li> <li>Appliance type</li> <li>Brand and model</li> </ul>
Thailand	India	Hong Kong
 <p>The image shows a Thai energy label with a semi-circular scale from 1 to 5. It includes a QR code and text in Thai and English, such as 'ประสิทธิภาพ: เครื่องปรับอากาศ FIXED SPEED' (Efficiency: Fixed Speed Air Conditioner) and 'SEER' (Seasonal Energy Efficiency Ratio).</p>	 <p>The image shows an Indian 'Power Savings Guide' label. It features a star rating from 1 to 5. The label displays 'ENERGY EFFICIENCY 2.90*' and 'EER (W/W)'. It also lists 'Appliance Type', 'Brand', 'Model/Year', 'Cooling Capacity (W)', 'Power Consumption (W)', and 'Variable Speed Compressor'.</p>	 <p>The image shows a Hong Kong energy label with a scale from 1 to 5. It includes the text 'ENERGY LABEL' and '能源標籤'. The label displays 'Annual Energy Consumption (kWh)' as 1106 and 'Cooling Capacity (kW)' as 2.54. It also lists 'Refrigerant', 'Room Air Conditioner Brand', 'Model', and 'Reference Number/Year'.</p>
<ul style="list-style-type: none"> <li>Energy Efficiency Ratio (EER)</li> <li>Seasonal Energy Efficiency Ratio (SEER)</li> </ul>	<ul style="list-style-type: none"> <li>Energy efficiency ratio (EER)</li> <li>Appliance type</li> <li>Model number</li> <li>Cooling capacity</li> <li>Power consumption</li> </ul>	<ul style="list-style-type: none"> <li>Energy efficiency</li> <li>Annual energy consumption (kWh/year)</li> <li>Cooling capacity (kW)</li> <li>Refrigerant used</li> <li>Model number, brand details etc.</li> </ul>

<sup>56</sup> Based on 27 cents per kWh electricity cost, 8 hours daily usage and 16 hours standby energy consumption

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Among the labels of different countries, the following parameters were observed to be the most significant for the labelling program in the Maldives:

- Value of CSPF (Wh/Wh)
- Test standard used
- Model-specific details such as
  - Type
  - Brand
  - Model number
  - Year of manufacturing
- Cooling capacity (Btu/h and kW)
- Refrigerant used

In addition to the above details, information on annual energy consumption and expected annual costs/savings are also displayed on few labels.

A consultative discussion was held within the stakeholders in the Maldives. The stakeholders were requested to provide their inputs on the proposed contents of EE label. The inputs were sought in the form of response towards a set of questions. **Based on the inputs from stakeholder it has been decided to include following aspects in the EE label for Air Conditioners:**

- Rating
- Value of CSPF (Wh/Wh)
- Test standards used
- Model specific detail
  - Type
  - Brand
  - Model number
  - Year of manufacture
- Cooling capacity (Btu/h)
- Refrigerant used
- Annual energy consumption (kWh/year)
- ODP
- Energy Saving compared to a 1-star product
- Registration number
- Date of issue of label



# 9. Proposed EE labelling program for refrigerators in the Maldives

## 9.1. Assessment based on key indicators and identifying the proposal for labelling programme

Based on the detailed findings presented in previous chapters, an evaluation matrix is developed to help make decisions to propose the most relevant way forward for standard & labelling program for refrigerators in the Maldives. Based on the information captured against each parameter a rating has been given. Three point rating method has been used. The nomenclature is shared below:

Rating	Meaning
Z	Neutral parameter
H	High relevance
M	Medium relevance
L	Low relevance

### Step 1: Assessment of scope of identified programs

Parameters	Scenario in Maldives	China	Singapore	Malaysia	Thailand	India
Scope	The majority of the market seems to be comprised of <b>single door and double door refrigerators</b> with the capacity ranging from <b>100l-650l</b> . Most of the refrigerators fall in the capacity range of <b>200l-400l</b> . There is a presence of DCR more prominently than FFRs.	All refrigerators are defined as with capacities from <b>15l and above</b> . Includes both single and double door refrigerators, with refrigerator freezers and without refrigerator freezers. Basically divided into refrigerators with no freezer compartments, refrigerators with 1 star, 2 star and 3 star freezers, and refrigerators	All refrigerators are defined as with capacities from <b>100l-900l</b> . Includes both single and double door refrigerators, with refrigerator freezers, with refrigerator freezers with TTD and without refrigerator freezers.	The Malaysian programme covers refrigerating appliances intended for household and similar use, with an adjusted volume <b>up to 800l</b> , both single and double door refrigerators.	The Thai programme covers refrigerating appliances intended for household and similar use, with single door refrigerators with an adjusted volume till 450l, and double door refrigerators with and adjusted volume of less than 450l and above. Both top and bottom freezer door refrigerators. It includes conventional as well as inverter type refrigerators. It also includes manual, semi-automatic and automatically defrosted refrigerators.	The Indian programme covers refrigerating appliances intended for household and similar use, with an adjusted volume from <b>50l-700l</b> , both DCR and FFR.
Rating		H	H	H	H	H

Parameters		Scenario in Maldives	China	Singapore	Malaysia	Thailand	India
Climate condition		The Maldives has a tropical monsoon climate, with average temperature around 30 degrees Celsius during the whole year	Mixed climate.	Uniform temperature and pressure, high humidity and abundant rainfall. <b>The average temperature lies between 25 and 31 degrees Celsius</b>	Equatorial climate, being hot and humid throughout the year. The average rainfall is 250 centimeters a year and <b>the average temperature is 27 °C</b>	Tropical climate with a <b>mean annual temperature of 27°C</b> and high humidity.	Mixed climate.
	Rating		L	H	H	H	L

From the above table, it can be assessed that the programs in China, Singapore, Malaysia, and Thailand and India capture the entire market scope in the Maldives. However, as the programs in India and China have disparities between their climate and that of the Maldives, the relevance of their programs on the basis of climate is reduced.

**Therefore, programs of Singapore, Malaysia and Thailand are shortlisted for the further assessment.**

## Step 2: Assessment of performance parameter for comparative labelling and test standards

Parameters	Scenario in Maldives	Singapore	Malaysia	Thailand
Parameter graded	<i>To be determined</i>	Annual energy consumption (kWh/year)	Energy Efficiency Factor ratio (Litres/kWh/day)	Annual energy consumption (kWh/year)
Test standard	As <b>Maldives doesn't</b> have localised test standards, globally recognised test standards such as ISO, IEC would be more relevant.	ISO15502 test procedure (or IEC 62552 edition 1).	ISO15502 test procedure (or IEC 62552 edition 1).	TIS 2186-2547:2004 or ISO15502 test procedure (or IEC 62552 edition 1)

All of the shortlisted programs have adopted the ISO 15502 test procedure (or IEC 62552 edition 1) as the reference test standard for refrigerators. Given the global acceptability of ISO/IEC test procedures and adoption of this standard in most relevant programs, **it is recommended that the same test standard & procedure, i.e. ISO 15502 test procedure (or IEC 62552 edition 1) be adopted for the refrigerator programme in Maldives as well.**

Regarding the parameters describing the performance of refrigerators, the Annual energy consumption (kWh/year) **is appropriate for the programme in Maldives**. This way, the performance criteria will be in line with the ones used in programs for refrigerators in most countries.

Overall, the programs in Singapore and Thailand have the same parameters graded to calculate the energy efficiency of the refrigerators and the same test standards followed. The two programs have been further assessed to understand their relevance for Maldivian context.

### Step 3: Assessment of programme parameters and determination of star rating band

The shortlisted programs have been assessed on the basis of their eligibility criteria, to identify the appropriate band range and the parameters to be included in the label contents. The information is presented in the following table.

Parameters	Singapore	Thailand
Eligibility criteria	Adherence to the MEPS requirements as defined by the National Environmental Agency (NEA)	Adherence to the MEPS requirements of Grade 3 for all capacities.
Label band range	1 Tick (worst) to 4 Ticks (best)	Grade 1 (worst) to Grade 5 (best)

Broadly, both of the programs could be applicable for Maldivian context. However, it would be useful to understand which of these two programs provides better relevance and also provides the opportunity to introduce most efficient products in the local market.

The most stringent programme out of the two can be evaluated considering an **example discussed below for illustration purpose:**

For a particular adjusted volume of a refrigerator, the Annual Energy Consumption (AEC) range for both the countries shall be calculated, and then shall be compared based upon the stringency of the labelling range.

Assumptions considered:

- For Direct Cool Refrigerators, the ratio of the capacity of freezer compartment to the capacity of refrigerator compartment can be taken approximately as 20:80. For Frost Free Refrigerators, the ration can be taken as 30:70.
- The freezer compartment assumed for the calculation is a three star freezer compartment.
- The ideal temperature of a 3 star freezer compartment is taken to be **-18°C. The ideal temperature of the refrigerator compartment is taken to be 4°C.**

#### Case 1: 200L single door DCR (3 star freezer compartment)

For a 200l single door DCR with a 3 star freezer compartment, the division of volumes shall be as follows:

- Volume of the freezer compartment =  $0.2 \times 200 = 40\text{l}$
- Volume of the refrigerator compartment =  $0.8 \times 200 = 160\text{l}$

The adjusted volume as per the Singaporean standards shall be:

$$AV = 1.0 \times 160 + 1.79 \times 40 = 231.6\text{l}$$

The adjusted volume as per the Thai standards shall be:

$$AV = 160 + [(32+18) / (32-4)] \times 40 = 231.4\text{l}$$

Therefore, for a 200l DCR, the AEC range for a particular grade for Singapore and Thailand shall be as follows:

**Table 76: Calculations for the AEC range for a 200l single door DCR (3 star freezer compartment)**

Grade	Range of AEC (in kWh) – Illustrative	
	Programme in Singapore	Programme in Thailand
1 (least efficient)	$433.63 \geq \text{AEC} > 334.83$	N.A.

2	$334.83 \geq \text{AEC} > 244.65$	N.A.
3	$244.65 \geq \text{AEC} > 178.78$	$257.50 \geq \text{AEC} > 235.25$
4	$178.78 \geq \text{AEC}$	$235.25 \geq \text{AEC} > 216.30$
5 (most efficient)	N.A.	$216.30 \geq \text{AEC}$

### Case 2: 400L double door FFR (3 star freezer compartment)

For a 400l double door FFR with a 3 star freezer compartment, the division of volumes shall be as follows:

- Volume of the freezer compartment =  $0.3 \times 400 = 120\text{l}$
- Volume of the refrigerator compartment =  $0.7 \times 400 = 280\text{l}$

The adjusted volume as per the Singaporean standards shall be:

$$\text{AV} = 1.0 \times 280 + 1.79 \times 120 = 494.81$$

The adjusted volume as per the Thai standards shall be:

$$\text{AV} = 280 + [(32+18) / (32-4)] \times 120 = 494.31$$

Therefore, for a 400l FFR, the AEC range for a particular grade for Singapore and Thailand shall be as follows:

*Table 77: Calculations for the AEC range for a 400l double door FFR (3 star freezer compartment)*

Grade	Range of AEC (in kWh/year) – Illustrative	
	Programme in Singapore	Programme in Thailand
1 (least efficient)	$580.30 \geq \text{AEC} > 489.70$	N.A.
2	$489.70 \geq \text{AEC} > 357.81$	N.A.
3	$357.81 \geq \text{AEC} > 261.48$	$635.55 \geq \text{AEC} > 580.78$
4	$261.48 \geq \text{AEC}$	$580.78 \geq \text{AEC} > 546.78$
5 (most efficient)	N.A.	$546.78 \geq \text{AEC}$

In both the cases, the AEC range for Singapore for all the grades are defined at a lower value of AEC as compared to that of Thailand. For e.g.:

- In Singapore's programme, for a 200l single door DCR, the highest energy efficient grade, 4 ticks, is defined at  $\text{AEC} \leq 178.78$  kWh/ year, whereas the highest energy efficiency grade for Thailand's programme, Grade 5, is defined at  $\text{AEC} \leq 216.30$  kWh/ year.
- Similarly, for a 400l double door FFR, the highest energy efficient grade for Singapore's programme, 4 ticks, is defined at  $\text{AEC} \leq 261.48$  kWh/ year, whereas the highest energy efficiency grade for Thailand's programme, Grade 5, is defined at  $\text{AEC} \leq 546.78$  kWh/ year.

Therefore, from the above assessment, it can be considered that the eligibility requirements in Singapore's programme are more stringent for refrigerators. Therefore, it is proposed that the label band in Singapore be adopted for the programme in the Maldives.

The subsequent section details the proposed labelling framework for refrigerators in Maldives.

## 9.2. Arriving the most suitable EE label range for Maldives

As the Singaporean programme is found out to be the most suitable one in the Maldivian context, it shall be used in the EE labelling programme for label in the Maldives.

However, the Singaporean label for the refrigerators uses 4 ticks, from Ticks 1 to Tick 4, whereas the MEA intends on implementing a uniform EE label for all the household appliances for the Maldives, which has a label range from Level 1 to Level 5.

The following point was discussed with the MEA, in which 3 options were put forward to adopt the Singaporean label in the Maldives:

### Option-1

In option 1, it was proposed that the Singaporean label is adopted as it is in the Maldives, with the range of refrigerators from Level 1 to Level 4, and for the other appliances, the range remains from Level 1 to Level 5.

### Option-2

In option 2, it was proposed that the Singaporean label is adopted with an additional level to be included in the label, which has the AEC calculation based upon the percentage increase in the correction coefficient for every grade. Thus, tick 1 to tick 4 of Singapore programme label is considered as level 2 to level 5 in Maldives and a hypothetical level 1 is introduced.

### Option-3

In option 3, it was proposed that the Singaporean label is adopted with shifting 1 tick to 4 ticks label range by 1 tick each, i.e. what is 1 tick in Singaporean label shall be level 2 in Maldivian label, what is 4 ticks shall be level 5. There shall be no refrigerator in the Maldives that shall fall into the category of level 1, as that shall correspond to a not applicable category.

After a thorough discussion with the concerned stakeholders, MEA decided to move forward with option 3. Option 3 shall have the Maldivian label as follows:

Energy efficiency grade	Singaporean EE label range	Maldivian EE label range
Grade 1 (least efficient)	1 Tick	Not Applicable
Grade 2	2 Tick	Level 2
Grade 3	3 Tick	Level 3
Grade 4	4 Tick	Level 4
Grade 5 (most efficient)		Level 5

## 9.3. Proposed energy efficiency labelling programme framework for refrigerators in the Maldives

The section summarises the proposal for S&L programme for refrigerators in the Maldives. The recommendations proposed.

*Table 78: Proposed energy efficiency labelling program in the Maldives for air refrigerators*

<b>Scope of the S&amp;L programme</b>	Compression-type Direct-Cool (single-door) refrigerators and Compression-type Frost-Free (double-door, three-door and side-by-side) refrigerators, intended for household use, including the rated capacities of 100l-650l.
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<b>Referred test standard</b>	ISO15502 test procedure (or IEC 62552 edition 1)
<b>Terms and definitions</b>	<p>As per ISO15502 test procedure (or IEC 62552 edition 1):</p> <ul style="list-style-type: none"> <li>• <b>Refrigerating appliance</b> is a factory-assembled insulated cabinet with one or more compartments and of suitable volume and equipment for household use, cooled by natural convection or a frost-free system whereby the cooling is obtained by one or more energy-consuming means.</li> <li>• <b>Refrigerator</b> is a refrigerating appliance intended for the preservation of food, one of whose compartments is suitable for the storage of fresh food.</li> <li>• <b>Compression-type refrigerating appliance</b> is a refrigerating appliance in which refrigeration is effected by means of a motor-driven compressor.</li> <li>• <b>Absorption-type refrigerating appliance</b> is a refrigerating appliance in which refrigeration is effected by an absorption process using heat as energy source.</li> <li>• <b>Refrigerator-freezer</b> is a refrigerating appliance having at least one compartment suitable for the storage of fresh food (the fresh-food storage compartment) and at least one other (the food freezer compartment) suitable for the freezing of fresh food and the storage of frozen food under three-star storage conditions.</li> <li>• <b>Frost-free refrigerator-freezer</b> is a refrigerator-freezer in which all compartments are automatically defrosted with automatic disposal of the defrosted water and at least one compartment is cooled by a frost-free system.</li> <li>• <b>Direct cool refrigerator-freezer</b> is a refrigerator-freezer in which all compartments are manually defrosted with manual disposal of the defrosted water.</li> <li>• The <b>energy consumption test</b> is the test for the energy consumption by the refrigeration appliance at an ISO tropical temperature of either 16°C or 32°C. Energy consumption is calculated as:  <b><math>Ex = E1 + (E2 - E1) \times (tx - t1) / (t2 - t1)</math></b>  t1 = measured compartment temperature for point 1  t2 = measured compartment temperature for point 2  tx = target temperature for the compartment for energy consumption determination  E1 = measured energy consumption of the appliance at point 1  E2 = measured energy consumption of the appliance at point 2  Ex = calculated energy consumption of the appliance at the target temperature tx.  <b>For the given conditions, tx = 32°C and Ex = E32.</b></li> <li>• <b>Calculation of V<sub>adj</sub></b> – The adjusted volume of a refrigerator shall be calculated through the following formula:  <math display="block">V_{adj} = \Sigma(K_c \times \text{Actual volume of the compartment})</math> K<sub>c</sub> is the volume correction factor for a particular type of compartment and is defined as follows:</li> </ul>

	Compartment Type		Volume Correction Factor ( $K_c$ )				
	Fresh Food		1.00				
	4 star freezer		1.79				
	3 star freezer		1.79				
	2 star freezer		1.57				
	1 star freezer		1.36				
	Chill		1.13				
	Cellar		0.75				
<b>Testing guidelines</b>	As per ISO15502 test procedure (or IEC 62552 edition 1)						
<b>Eligibility requirements for minimum coefficient of performance (MEPS) requirements</b>	Type		Annual Energy Consumption (AEC) in kwh				
			MEPS level				
	Without freezer		$[(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.551] \geq \text{AEC} > [(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.461]$				
	With freezer ( $V_{adj} \text{ tot} \leq 300$ litres)		$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.553] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.427]$				
	With freezer ( $V_{adj} \text{ tot} > 300$ and $\leq 900$ litres)		$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.506] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.427]$				
With freezer, through-the-door ice dispenser		$[(585 + 1.378 \times V_{adj} \text{ tot}) \times 0.485] \geq \text{AEC} > [(585 + 1.378 \times V_{adj} \text{ tot}) \times 0.409]$					
<b>Other eligibility requirements (if any)</b>	—						
<b>Rating scheme</b>	Type		Annual Energy Consumption (AEC) in kwh				
			Level 1	Level 2	Level 3	Level 4	Level 5
	Without freezer	Not Applicable	$[(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.551] \geq \text{AEC} > [(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.461]$	$[(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.461] \geq \text{AEC} > [(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.332]$	$[(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.332] \geq \text{AEC} > [(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.239]$	$[(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.239] \geq \text{AEC} > [(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.136]$	$[(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.136] \geq \text{AEC} > [(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.033]$
			$[(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.461] \geq \text{AEC} > [(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.332]$	$[(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.332] \geq \text{AEC} > [(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.239]$	$[(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.239] \geq \text{AEC} > [(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.136]$	$[(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.136] \geq \text{AEC} > [(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.033]$	$[(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.033] \geq \text{AEC} > [(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.033]$
With freezer ( $V_{adj} \text{ tot} \leq 300$ litres)	Not Applicable	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.553] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.427]$	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.427] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.312]$	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.312] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.228]$	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.228] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.136]$	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.136] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.033]$	
		$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.427] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.312]$	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.312] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.228]$	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.228] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.136]$	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.136] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.033]$	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.033] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.033]$	
With freezer ( $V_{adj} \text{ tot} > 300$ and $\leq 900$ litres)	Not Applicable	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.506] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.427]$	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.427] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.312]$	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.312] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.228]$	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.228] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.136]$	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.136] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.033]$	
		$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.427] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.312]$	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.312] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.228]$	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.228] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.136]$	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.136] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.033]$	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.033] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.033]$	

	With freezer, through-the-door ice dispenser	Not Applicable	$\frac{[(585 + 1.378 \times \text{Vadj tot}) \times 0.485]}{\text{AEC}} \geq \frac{[(585 + 1.378 \times \text{Vadj tot}) \times 0.409]}{\text{AEC}}$	$\frac{[(585 + 1.378 \times \text{Vadj tot}) \times 0.409]}{\text{AEC}} \geq \frac{[(585 + 1.378 \times \text{Vadj tot}) \times 0.298]}{\text{AEC}}$	$\frac{[(585 + 1.378 \times \text{Vadj tot}) \times 0.298]}{\text{AEC}} \geq \frac{[(585 + 1.378 \times \text{Vadj tot}) \times 0.218]}{\text{AEC}}$	$\frac{[(585 + 1.378 \times \text{Vadj tot}) \times 0.218]}{\text{AEC}} \geq \text{AEC}$
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A consultative discussion was held within the stakeholders in the Maldives to discuss about the proposed energy efficiency labelling program for refrigerator. **Based on the inputs from stakeholder the proposed energy efficiency program has been updated and it is provided in Appendix B.**



## 9.4. Recommendations on label design and content

In the previous subsection, we have proposed that the labelling scheme for refrigerators in Singapore be adopted for the labelling program in the Maldives. As such, the Annual Energy Consumption (in kWh/ year) shall be graded from Level 1 to Level 4 on the label.

However, other relevant information, to be displayed separately on the label are identified in this sub-section. We first understand the various parameters displayed on labelling programs of other countries identified in the report:

Table 79: Label contents in various countries' labelling programs

China	Singapore	Malaysia
		
<ul style="list-style-type: none"> <li>• Product Manufacturer</li> <li>• Product Model Number</li> <li>• Level</li> <li>• Energy Consumption</li> <li>• Energy Efficiency</li> </ul>	<ul style="list-style-type: none"> <li>• Energy efficiency rating</li> <li>• Ticks</li> <li>• Annual energy cost</li> <li>• Annual energy consumption</li> <li>• Brand Name</li> <li>• Model Number</li> <li>• Type of Refrigerator</li> <li>• Total Storage Volume (L)</li> <li>• Test Standard</li> <li>• Disclaimer</li> <li>• Registration Number</li> </ul>	<ul style="list-style-type: none"> <li>• Energy rating in stars</li> <li>• Appliance Type</li> <li>• Appliance Energy Rating</li> <li>• Brand and model information</li> <li>• Energy Consumption</li> <li>• Energy savings compared to lowest 2 star rated product</li> <li>• Testing standards used at lab conditions</li> </ul>
Thailand	India	
		
<ul style="list-style-type: none"> <li>• Grade (in no.) as per the label</li> </ul>	<ul style="list-style-type: none"> <li>• Star Label</li> </ul>	

<ul style="list-style-type: none"> <li>• Year of certification criteria</li> <li>• Type of appliance</li> <li>• Energy consumption (kWh/year)</li> <li>• Electricity cost (Baht/year)</li> <li>• Energy efficiency ratio</li> <li>• Product Details like model number, model name, brand name</li> </ul>	<ul style="list-style-type: none"> <li>• Electricity Consumption</li> <li>• Label Period</li> <li>• Appliance/Type</li> <li>• Model/Year</li> <li>• Type</li> <li>• Gross Volume</li> <li>• Storage Volume</li> <li>• BEE Logo</li> <li>• Disclaimer for calculation of electricity consumption</li> </ul>	
--	--	--

Among the labels of different countries, the following parameters were observed to be the most significant for the labelling program in the Maldives:

- Energy Efficiency Rating
- Ticks
- Annual Energy Consumption (kWh/ year)
- Brand name
- Model number
- Type of refrigerator
- Total storage volume (L)
- Test Standard
- Annual Energy Cost

In addition to the above details, the registration number is also displayed on the label.

A consultative discussion was held within the stakeholders in the Maldives. The stakeholders were requested to provide their inputs on the proposed contents of EE label. The inputs were sought in the form of response towards a set of questions. **Based on the inputs from stakeholder it has been decided to include following aspects in the EE label for Refrigerator:**

- Rating
- Annual Energy Consumption (kWh/year)
- Test Standards used
- Model specific detail
  - Type
  - Brand
  - Model number
  - Year of manufacture
- Total storage volume (L)
- Registration number
- Refrigerant used
- ODP
- Energy Saving Compared to a 1 Star product

- 
- Total Gross Volume
  - Date of issue of label

# 10. Proposed EE labelling program for washing machines in the Maldives

## 10.1. Assessment of international labelling programs and identifying the proposal for labelling program for washing machines

The following evaluation matrix is developed to help make decisions to propose the most relevant way forward for standard & labelling program for washing machines in the Maldives.

Table 80: Country specific assessment of labelling programs for washing machines

Parameters	Scenario in Maldives	China	Singapore	Thailand	UAE	Hong Kong
Scope	The market in Maldives comprises of top loaders, front loaders and twin tub in the order of market sales. Fully automatic top loaders have the majority.	All washing machines for household use, including top loader impellor machines and front loaders (drum type) (considers household electric washing machines of which the rated washing capacity is <b>13 kg and below</b> )	Automatic front and top loading residential washing machines (the program <b>doesn't</b> differentiate the functionality /type of machines) (considers washing capacity normally <b>not exceeding 10 kg</b> for household use)	Washing machines for household use and similar functions, used with alternate currents of not more than 250 volts for single phase, and not more than 480 volts for 3 phase, either with or without heating equipment, providing hot or cold washes, including combination washer dryers	All clothes washing machines for household use, with or without heating devices and for cold and/or hot water supply. Washing machines for communal use in block of flats or in launderettes up to <b>20 kg</b> capacity are also included	All residential washing machines (have a rated washing capacity <b>not exceeding 7 kg</b> )
Program type (mandatory /voluntary)	In an import driven market like the Maldives, a voluntary programme followed by conversion to mandatory in defined timeline is preferable	Mandatory	Mandatory	Voluntary	Mandatory	Mandatory
Parameter graded	<i>To be determined</i>	Energy efficiency Water efficiency Wash performance	Drum volume to capacity (L/kg)	<i>Not applicable (endorsement labelling)</i>	Energy efficiency Spin drying efficiency	Energy efficiency
Minimum qualification criteria	<i>To be determined</i>	Adherence to MEPS requirements (Tier 5) Top loaders: <ul style="list-style-type: none"> <li>• <b>Energy</b> ≤ 0.022 kWh per cycle per kg</li> </ul>	Not applicable	Energy consumption for cold wash (per cycle) <ul style="list-style-type: none"> <li>• <b>Upto 6kg</b> ≤ 25 Wh/kg</li> <li>• <b>7 to 8 kg</b> ≤ 20 Wh/kg</li> <li>• <b>9 to 10 kg</b> ≤ 16 Wh/kg</li> </ul>	<b>Front loaders</b> ≤ 170 Wh/kg/cycle  Top load and twin tub < 26 Wh/kg/cycle	Front loaders: <ul style="list-style-type: none"> <li>• Washing performance ≥ 70%</li> <li>• Water extraction performance: Remaining moisture content ≤ 1.1</li> </ul>

Parameters	Scenario in Maldives	China	Singapore	Thailand	UAE	Hong Kong
		<ul style="list-style-type: none"> <li>Water ≤ 28 litres per cycle per kg</li> <li>Wash performance ≥ 80%</li> </ul> Front loaders: <ul style="list-style-type: none"> <li>Energy ≤ 0.19 kWh per cycle per kg</li> <li>Water ≤ 12 litres per cycle per kg</li> <li>Wash performance ≥ 103%</li> </ul>		<ul style="list-style-type: none"> <li>11 to 12 kg ≤ 13 Wh/kg</li> </ul> Energy consumption for hot wash (per cycle) should be ≤ 170 Wh/kg Minimum wash performance ≥ 80% Water consumption <ul style="list-style-type: none"> <li>Upto 6kg ≤ 28 L/kg</li> <li>7 to 8 kg ≤ 26 L/kg</li> <li>9 to 10 kg ≤ 24 L/kg</li> <li>11 to 12 kg ≤ 22 L/kg</li> </ul> Noise while washing ≤ 50 dB, while drying ≤ 55 dB		Top loaders: <ul style="list-style-type: none"> <li>Washing performance, C ≥ 70%</li> <li>Water extraction efficiency ≥ 0.47</li> </ul> <p><i>If the above qualification is not met then the washing machine is provided the lowest grade</i></p>
Label type	A comparative label is preferred for adoption in Maldives	Comparative	Comparative (only for drum volume)	Endorsement	Comparative	Comparative
Label band range	To be decided	Tier 1 (best) to Tier 5 (worst)	1 Tick (worst) to 4 Ticks (best)	Not applicable	1 star (least) to 5 star (best)	Grade 1 (Best) to Grade 5 (Worst)
Information present on the label	To be decided	<ul style="list-style-type: none"> <li>Energy consumption per cycle</li> <li>Water consumption per cycle</li> <li>Washing effectiveness</li> <li>Rated wash capacities</li> </ul>	<ul style="list-style-type: none"> <li>Water consumption</li> <li>Type of product</li> <li>Brand</li> <li>Model</li> <li>Registration number</li> </ul>	Not applicable	<ul style="list-style-type: none"> <li>Annual energy consumption (KWh/year)</li> <li>Annual water consumption (L/year)</li> <li>Capacity (kg)</li> <li>Brand name, model number etc.</li> </ul>	<ul style="list-style-type: none"> <li>Annual energy consumption (kWh/year)</li> <li>Wash capacity</li> <li>Water consumption</li> <li>Model number, brand details etc.</li> </ul>
Test standard	As Maldives doesn't have localised test standards, globally recognised test standards such as ISO, IEC would be preferred	GB standard Based on: <ul style="list-style-type: none"> <li>JIS 9606 for top loader impellor machines</li> <li>IEC 60456 for drum type front loaders</li> </ul>	Not applicable	TIS 1462 based on <ul style="list-style-type: none"> <li>IEC 60456 for front loaders, and</li> <li>JIS 9606 for top loaders</li> </ul>	UAE.S IEC 60456: 2010	IEC 60456 for front loaders  JIS 9606 for top loaders
Tests prescribed	To be decided	<ul style="list-style-type: none"> <li>Wash performance</li> <li>Energy consumption per cycle</li> <li>Water consumption per cycle</li> </ul>	Not applicable	<ul style="list-style-type: none"> <li>Wash performance</li> <li>Energy consumption</li> <li>Water consumption</li> <li>Noise</li> </ul>	<ul style="list-style-type: none"> <li>Energy consumption</li> <li>Water consumption</li> <li>Spin Extraction Performance for Washing Machines</li> </ul>	<ul style="list-style-type: none"> <li>Wash performance</li> <li>Energy consumption</li> <li>Water consumption</li> <li>Spin drying efficiency</li> </ul>

Parameters	Scenario in Maldives	China	Singapore	Thailand	UAE	Hong Kong
					<ul style="list-style-type: none"> <li>Condensation Efficiency for Condenser Dryers</li> </ul>	

The review conducted in the above table reveals that international labelling programs for washing machines (or clothes washers) are generally more diverse in nature, given the complex nature of the appliance. The parameters considered for the labelling programs is one area of diversity among the programs considered. While all programs except that in Singapore consider energy efficiency as an important parameter for determining the rating of the product, the other parameters considered for labelling vary significantly:

- The label in China also considers water efficiency and wash performance to determine the Tier rating for a product.
- In the UAE, the energy performance, rinse efficiency and water consumption are indicated separately on the label.
- While Hong Kong only considers energy performance for determining the grade for a product, annual energy consumption and other details are mentioned separately.
- Singapore considers only water consumption (by simply calculating drum volume per rated wash capacity) for its label.
- The Green Label program in Thailand is the most comprehensive in terms of the number of parameters considered. The program considers energy consumption, water consumption, wash performance, noise, and few manufacturing related criteria.

However, unlike for parameters assessed, considerable homogeneity was observed regarding the test standards followed in labelling programs across all countries. **All programs except that of Singapore & UAE have based their performance test procedures on the basis of IEC 60456 for front loaders and JIS 9606 for top loaders.** The front loaders (drum type) are generally tested at the cotton 60 degree cycle across all programs. JIS 9606 mandates the use of cotton 20 degree cycle.

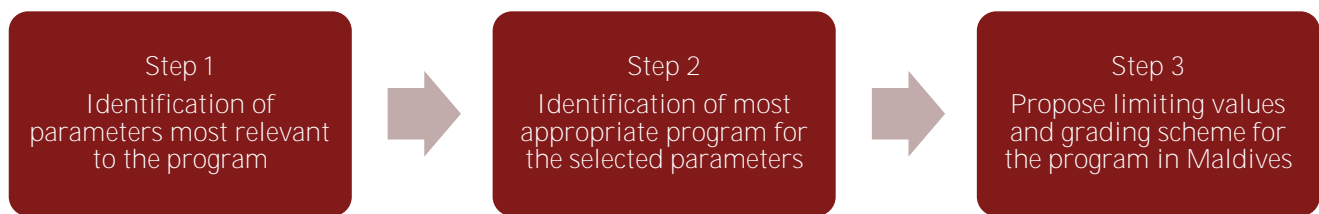
In terms of stringency of requirements, all programs (except Singapore) have approximately similar requirements for energy efficiency. However, the program in Thailand stands out as the most stringent in terms of minimum qualification requirement for energy and water efficiency. The other programs have high stringency requirements for achieving the highest ratings.

### **Relevance to the local context in the Maldives**

During the assessment, **it is observed that each program has certain features that are extremely relevant to the local context in the Maldives.** For example, the program in China incorporates both water consumption and wash performance in determining the label grade. Both these factors are extremely relevant to the Maldives. The program in Singapore focusses on water only and is extremely simple to administer, as no specific test criteria are prescribed. The program in UAE emulates the one in the EU in providing the consumer all the relevant information during time of purchase.

In this situation, **it is proposed that a customised labelling program be developed for the Maldives, with the test procedure harmonised with those adopted in other countries.** The label contents and grading be customised as per local requirements, and the grading scheme/qualification requirements be adopted from a particular programme.

The approach proposed for development of the labelling program in the Maldives is summarised below:



*Figure 11: Proposed approach*

### **Step 1: Identification of parameters most relevant to the local context in the Maldives**

The assessment above describes the various parameters important for assessing the performance of washing machines from a standards & labelling point of view. This subsection deals with identification of performance parameters most relevant for the labelling program in the Maldives. Among the international labelling programs assessed, the following parameters were identified as important for further consideration:



*Figure 12: Parameters most relevant to the local context*

The key agenda here is to identify those parameters which shall be considered for grading /comparative labelling as well as define those parameters which will be only for the purpose of display on the label and/or for setting the minimum qualification criteria for the standards and labelling programme.

The following points discuss the brief description on each of the parameter and its specific need for the programme:

- Based on the assessment, it is believed that **energy efficiency as a parameter is of paramount importance for any energy efficiency labelling programme, and must be graded (use for comparative labelling). Additionally, it is proposed that an approximate estimate of annual energy consumption [and consequently, annual cost of operation] should be displayed on the label** to further empower the consumers to make an informed choice.
- The discussions with key stakeholders in the Maldives [see chapter 3] brought out that water efficiency is extremely relevant in the Maldives, given the local context. Consequently, **it is proposed to include water efficiency (consumption) in the overall grading scheme, or be displayed separately.** The possible mechanisms are described below:
  - ✓ Define the comparative band for water consumption as done in China. The product models shall be labelled with a particular label band on the basis of its energy efficiency and water consumption.
  - ✓ Another option is to consider water consumption value as a display on the label. In this case the labelling is irrespective of water consumption. The consumer can differentiate the washing machines based on the water consumption value displayed.
- **Wash performance** is an important metric for a washing machine, and must not be allowed to deteriorate in order to improve energy and water performance. However, as the wash performance is included as a percentage, its absolute value has no real significance, and therefore serves no purpose if

displayed separately. Also, it is known that improving wash performance beyond a certain percentage [90%] has no significant marginal improvement on cleaning performance. Therefore, **it is proposed that a minimum qualification requirement be placed for wash performance.**

- The **spin drying efficiency** relates to removal of water content during rinse cycle. The spin drying efficiency is considered only in UAE for grading amongst the international programs assessed. Considering the local context, it would be important to just define the minimum qualification for spin drying efficiency. Consideration of grading might limit the import of washing machines from certain countries in the beginning. Hence, to begin with **it is proposed that a minimum qualification for spin drying efficiency is defined.**
- While the parameter noise is related to the performance of a washing machine, it holds limited relevance to the local context. Noise is not considered in most of the international programs. Consideration of this parameter might limit the import of washing machines from certain countries in the beginning. Hence, to begin with it is proposed that this is not considered for the labelling programme.

*Table 81: Design of washing machine label in the Maldives*

Performance parameters	Relevance <sup>57</sup>	To be graded or displayed or both?	Set minimum performance requirement?
<b>Energy consumption [per cycle] kWh/kg</b>	The per-cycle energy consumption is the total energy consumed by a washing machine in one cycle of a standardized wash/rinse program. This value also comprises of energy required to increase water temperature. <i>All programs discussed above use the ratio of per cycle energy consumption to washing capacity of the machine as an indicator of energy efficiency.</i>	Both	Yes
<b>Water consumption [per cycle] L/kg</b>	The per-cycle water consumption is the total water consumed by a washing machine in one cycle of a standardized wash/rinse program. <i>The ratio of per cycle water consumption to washing capacity of the machine is generally used as an indicator for water efficiency.</i>	Either grade or display	Yes
<b>Wash performance %</b>	The wash performance of a washing machine model indicates its performance in removing different types of soils from a test cloth relative to that of a reference machine.	No	Yes
<b>Water extraction (Spin drying efficiency) RMC<sup>58</sup> %</b>	The Remaining Moisture Content (RMC), indicated as a percentage, is indicative of the ability of the machine to remove water from the load after the rinse cycle.	No	Yes
<b>Noise dB</b>	The noise levels during washing and drying of clothes, displayed in decibels.	No	No

<sup>57</sup> As per IEC 60456

<sup>58</sup> RMC stands for Remaining Moisture Content



## Step 2: Identification of most relevant program for shortlisted parameters

While the proposal on shortlisted parameters has been described above, this subsection analyses how these parameters are captured in the five international programs considered for the assessment. The information is summarised in the following table. The relevance of the labelling program to the local context is also assessed.

Table 82: Country specific assessment for relevant parameters

Program	Energy	Water	Wash performance	Water extraction (Spin drying efficiency)	Relevance to the context in the Maldives
<b>China</b>	<b>Simultaneous Grading</b> of energy efficiency (kWh/kg), water efficiency (L/kg), and wash performance (%) <b>in one band</b> In addition, <b>energy consumption per cycle and water consumption are also displayed on the label</b>			-	●●● (high)
<b>Singapore</b>	-	Grading of drum volume by wash capacity (L/kg)	-	-	●●●
<b>Thailand</b>	Minimum requirement for energy efficiency (Wh/kg)	Minimum requirement for water efficiency (L/kg)	Minimum requirement for wash performance (%)	-	●●●
<b>UAE</b>	<b>Independent grading</b> of energy efficiency (Wh/kg)	Annual water consumption (L) displayed on label	-	<b>Independent grading</b> of spin drying efficiency (RMC %)	●●●
<b>Hong Kong</b>	<b>Independent grading</b> of energy efficiency (Wh/kg)	Annual water consumption (L) displayed on label	<i>Minimum requirement to qualify for Grade 1 to Grade 4 of the label</i>	<i>Minimum requirement to qualify for Grade 1 to Grade 4 of the label</i>	●●●

The above matrix indicates that the program design in China and Hong Kong are the most suited to the requirements identified in the previous sub-section. Amongst these two, the programme in Hong Kong is lesser relevant for Maldivian context as it only consider washing machines of capacity upto 7 kg. The local market in the Maldives have significant share of washing machines with capacity of upto 10kg. Therefore, the most relevant international programme amongst the above for the Maldives is the programme in China.

However, the contents from the international programme should be customised for design of the label in the Maldives. The factors considered include relevance for promoting the most efficient product, simplicity of program, addressing the expectation of addressing the Maldives context, and market characteristics.

The proposed preferences /options for designing the labelling framework are as follows:

**Table 83: Preferences for program design**

	<b>Parameters graded</b>	<b>Minimum qualification requirements</b>	<b>Information to be displayed on the label</b>
<b>Preference 1</b>	Energy efficiency (kWh/kg)	Wash performance (%) Water efficiency (L/kg) Remaining moisture content limit (%)	Annual energy consumption (kWh) Annual water consumption (L) <i>Annual energy cost (MVR) - optional</i>
<b>Preference 2</b>	Energy efficiency (kWh/kg) Water efficiency (L/kg) Wash performance (%) <i>Simultaneous grading like the program in China</i>	Wash performance (%) Water efficiency (L/kg) Remaining moisture content limit (%)	Annual energy consumption (kWh) Annual water consumption (L) <i>Annual energy cost (MVR) - optional</i>
<b>Preference 3</b>	Energy efficiency (kWh/kg)	<b>No minimum qualification requirements</b> <i>However, models failing to meet requirements against the following criteria only qualify for the lowest rating:</i> Wash performance (%) Water efficiency (L/kg) Remaining moisture content limit (%)	Annual energy consumption (kWh) Annual water consumption (L) <i>Annual energy cost (MVR) - optional</i>
<b>Preference 4</b>	Energy efficiency (kWh/kg) Water efficiency (L/kg) Wash performance (%) <i>Simultaneous grading like the program in China</i>	<b>No minimum qualification requirements.</b> <i>However, models failing to meet requirements against the following criteria only qualify for the lowest rating:</i> Wash performance (%) Water efficiency (L/kg) Remaining moisture content limit (%)	Annual energy consumption (kWh) Annual water consumption (L) <i>Annual energy cost (MVR) - optional</i>

The exact label design must be selected by consultation with stakeholders of the programme, such as MEE, MEA and importers.

**In the meanwhile, it is suggested the labelling scheme on the basis of preference 2, emulating the China programme** could be considered for adoption in the Maldives. However, the programme in China does not specify the minimum requirement for water extraction efficiency therefore it is not possible to arrive at the value for minimum water extraction efficiency in the programme design.

The following section details the proposed labelling framework for washing machines in the Maldives.

## 10.2. Proposed energy efficiency labelling programme framework for washing machines in the Maldives

Table 84: Proposed framework for washing machine labelling program

<b>Scope of the S&amp;L programme</b>	All residential washing machines, including automatic and semi-automatic, with horizontal axis (front loaders or vertical axis (top loaders) with a capacity of upto 14 kg																																																					
<b>Referred test standard</b>	<ul style="list-style-type: none"> <li>IEC 60456 for front loaders</li> <li>JIS 9606 for top loaders</li> </ul>																																																					
<b>Programme referred</b>	<ul style="list-style-type: none"> <li>Standard cotton 60 degree Celsius for front loaders</li> <li>As prescribed by JIS 9606 for top loaders</li> </ul>																																																					
<b>Terms and definitions</b>	All definitions as per IEC 60456 for front loaders and JIS 9606 for top loaders																																																					
<b>Testing guidelines</b>	<ul style="list-style-type: none"> <li>Test procedure – as described in IEC 60456 for front loaders, JIS 9606 for top loaders</li> <li>Test parameters – wash performance, rinse performance, spin extraction performance, water consumption per cycle, energy consumption per cycle</li> </ul>																																																					
<b>Eligibility requirements for minimum qualification (MEPS)<sup>59</sup></b>	<ul style="list-style-type: none"> <li>Water consumption – 28 L/kg for top loaders, 12 L/kg for front loaders</li> <li>Wash performance – 80% for top loaders, 103% for front loaders</li> <li>Water extraction efficiency (RMC) ≤ ____% for Top loaders (test as per JIS 9606)</li> <li>Water extraction efficiency (RMC) ≤ ____% for Front loaders (test as per IEC 60456)</li> </ul>																																																					
<b>Other requirements (if any)</b>	None																																																					
<b>Rating scheme</b>	<table border="1"> <thead> <tr> <th rowspan="2">EE Level</th> <th colspan="3">Top load (impeller type)</th> <th colspan="3">Front load (drum type)</th> </tr> <tr> <th>Electricity use (max) kWh per cycle per kg</th> <th>Water use (max) L per cycle per kg</th> <th>Cleaning performance (min)</th> <th>Electricity use (max) kWh per cycle per kg</th> <th>Water use (max) L per cycle per kg</th> <th>Cleaning performance (min)</th> </tr> </thead> <tbody> <tr> <td><b>Level 5 (highest)</b></td> <td>0.011</td> <td>14</td> <td>0.90</td> <td>0.11</td> <td>7</td> <td>1.03</td> </tr> <tr> <td><b>Level 4</b></td> <td>0.012</td> <td>16</td> <td>0.80</td> <td>0.13</td> <td>8</td> <td>1.03</td> </tr> <tr> <td><b>Level 3</b></td> <td>0.015</td> <td>20</td> <td>0.80</td> <td>0.15</td> <td>9</td> <td>1.03</td> </tr> <tr> <td><b>Level 2</b></td> <td>0.017</td> <td>24</td> <td>0.80</td> <td>0.17</td> <td>10</td> <td>1.03</td> </tr> <tr> <td><b>Level 1 (lowest)</b></td> <td>0.022</td> <td>28</td> <td>0.80</td> <td>0.19</td> <td>12</td> <td>1.03</td> </tr> </tbody> </table>						EE Level	Top load (impeller type)			Front load (drum type)			Electricity use (max) kWh per cycle per kg	Water use (max) L per cycle per kg	Cleaning performance (min)	Electricity use (max) kWh per cycle per kg	Water use (max) L per cycle per kg	Cleaning performance (min)	<b>Level 5 (highest)</b>	0.011	14	0.90	0.11	7	1.03	<b>Level 4</b>	0.012	16	0.80	0.13	8	1.03	<b>Level 3</b>	0.015	20	0.80	0.15	9	1.03	<b>Level 2</b>	0.017	24	0.80	0.17	10	1.03	<b>Level 1 (lowest)</b>	0.022	28	0.80	0.19	12	1.03
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**<sup>59</sup> Note for water extraction efficiency:** The value for water extraction efficiency has been kept blank in the above framework. The value needs to be arrived based on the performance data of washing machines that are being brought in the Maldives. It is suggested that, to begin with MEA shall introduce the programme without minimum requirement for water extraction efficiency. During the programme implementation phase, MEA shall sought the test report for the washing machines which shall have the information on water extraction efficiency. A database shall be developed for water extraction efficiency values and based on this the MEA shall incorporate a prescribed minimum value for water extraction efficiency in consultation with stakeholders.

### Other additional requirements that may be covered:

However, the program in Thailand considers the following aspects in addition to energy efficiency:

- Sound requirements
- Other than the above parameters, programs in China & Hong Kong also display the annual energy consumption and annual energy cost/saving as a part of the label.

**It is recommended that relevant stakeholders in the country deliberate whether the additional requirements are suitable to the Maldives' context.**

A consultative discussion was held within the stakeholders in the Maldives to discuss about the proposed energy efficiency labelling program for washing machine. **Based on the inputs from stakeholder the proposed energy efficiency program has been updated and it is provided in Appendix B.**

## 10.3. Recommendations on label design and content

There is a need to first understand the various parameters displayed on labelling programs of other countries identified in the report (replicated from section 6.6.):

Countries	Technical Parameters	
	Label Content	Graded Parameter
China	<ul style="list-style-type: none"><li>• Energy Consumption per cycle</li><li>• Water consumption per cycle</li><li>• Washing Effectiveness</li><li>• Rated wash capacities</li></ul>	<ul style="list-style-type: none"><li>• Energy Efficiency</li><li>• Water efficiency</li><li>• Wash performance</li></ul>
Thailand	Not applicable	Not applicable
Singapore	<ul style="list-style-type: none"><li>• Tick Marks</li><li>• Model</li><li>• Brand</li><li>• Registration Number</li></ul>	<ul style="list-style-type: none"><li>• Water Factor</li></ul>
Hong Kong	<ul style="list-style-type: none"><li>• Annual energy consumption (kWh/year)</li><li>• Wash capacity</li><li>• Water consumption</li><li>• Model number, brand details etc.</li></ul>	<ul style="list-style-type: none"><li>• Energy Efficiency</li></ul>
UAE	<ul style="list-style-type: none"><li>• Annual energy consumption (KWh/year)</li><li>• Annual water consumption (L/year)</li><li>• Capacity (kg)</li><li>• Brand name, model number etc.</li><li>• Disclaimer for calculation of electricity consumption</li></ul>	<ul style="list-style-type: none"><li>• Energy efficiency</li><li>• Spin drying efficiency</li></ul>

Among the labels of different countries, the following parameters were observed to be the most significant for the labelling programme in the Maldives:

- Value of per cycle energy consumption (kWh/cycle)

- 
- Value of per cycle water consumption (L/cycle)
  - Test standard used
  - Model-specific details such as
    - Type
    - Brand
    - Model number
    - Year of manufacturing

In addition to the above details, information on annual energy consumption and expected annual costs/savings are also displayed on few labels.

A consultative discussion was held within the stakeholders in the Maldives. The stakeholders were requested to provide their inputs on the proposed contents of EE label. The inputs were sought in the form of response towards a set of questions. **Based on the inputs from stakeholder it has been decided to include following aspects in the EE label for Washing Machine:**

- Rating
- Value of per cycle energy consumption (kWh/cycle)
- Water of per cycle water consumption (L/cycle)
- Test standard used
- Model specific detail
  - Type
  - Brand
  - Model number
  - Year of manufacture
- Capacity (kg)
- Annual energy consumption (kWh/year)
- Registration number
- Energy Saving compared to a 1 star product
- Date of issue of label

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# ***11. Integration of climate change initiatives with S&L***

## ***11.1. Introduction to Montreal Protocol***

On 16 September 1987, the Montreal Protocol on “Substances that Deplete the Ozone Layer” was signed which entered into force on 1 January 1989. The international agreement was signed by 197 developed and developing countries, which are committed to phase-out the consumption and production of ODS such as chlorofluorocarbons (or CFCs) and halons. The protocol has since undergone several amendments and adjustments in order to accelerate the phase-out schedules in London in 1990, Copenhagen in 1992, Vienna in 1995, Montreal in 1997 and Beijing in 1999.

## ***11.2. Overview of the ongoing measures in the Maldives***

Classified as an Article 5 country of the Montreal Protocol, Maldives ratified the various amendments under Montreal Protocol through the formulation of its HCFC Phase-out Management Plan (HPMP) in 2010.

The Ministry of Environment and Energy (MEE), under the Government of Maldives, is responsible for implementation of the Montreal Protocol and the National Ozone Unit (NOU) acts as the national coordinator on programmes drawing up necessary policies and regulation for the implementation. The country has adopted the ‘low carbon development’ policy.

Subsequently, in 2016, the MEE under Government of Maldives have formulated the “Ozone Layer Protection” Act and respective regulation. The Act is provided for reducing, controlling and managing the import and use of ozone depleting substances, alternatives to ozone depleting substances and its equipment to the Maldives. The Annex 1 of the Act covers the list of chemicals which are prohibited. These are chemical substances which have prescribed to be prohibited under Montreal Protocol. Annex 2 of the Act provides list of chemicals which are controlled as per the guidelines from Montreal Protocol. The ministry governs the overall mechanism for permitting the import of controlled chemicals within the limits as approved by the Ministry.

## ***11.3. Introduction to the Kigali amendment***

On 15 October 2016, the Parties to the Montreal Protocol adopted the Kigali Amendment that added hydrofluorocarbon (HFC) to the list of controlled substances. HFCs, initially considered a part of the solution to ozone depletion, turned out to be a very powerful greenhouse gas with a global warming potential thousand times that of CO<sub>2</sub>. With the Kigali Amendment, countries under the Montreal Protocol community agreed to a timeline for gradual reduction of HFC by 80-85 per cent by the late 2040 by drawing a set of differentiated baseline and freeze years within both developing (Article-5) and developed (non-Article 5) countries.

The Kigali Amendment adds to the Montreal Protocol the phase-down of the production and consumption of HFCs.

## ***11.4. Climate linkages***

The use of HFCs and their resulting emissions are reported to the UNFCCC as substances to be limited or reduced. This also applies to CO<sub>2</sub> emissions resulting from the fossil fuel based electricity generation needed to run cooling

appliances. In the run up to the Paris climate negotiations in 2015, parties representing over 90% of global GHG emissions had communicated targets for reducing national emissions in their Intended Nationally Determined Contributions (INDCs) which are the fundamental to the Paris Agreement. Analyses have shown that the collective effort – if all INDCs were to be fully implemented – would not be enough to limit the global temperature increase to the target of 2°C. **Therefore, the Paris Agreement must not only ensure full implementation of the INDCs as they are but also help to increase the level of ambition of individual commitments significantly over time.**

Parties are mandated to revise their national contributions every five years, starting in 2021 (with the option to do so before on a voluntary basis), and to prepare concrete implementation plans. INDCs become Nationally Determined Contributions (NDC) upon presentation of the ratification instrument or formal accession to the Paris Agreement. As part of their NDCs, countries are encouraged to present their commitments or targets to reduce GHG emissions over time. Some countries opted to present economy wide GHG reduction targets, citing either absolute or relative targets (e.g. related to a BAU scenario), some countries also presented sector based targets. Other countries, mostly least developed countries, chose specific policy commitments or actions as their mitigation contribution. Generally, countries are encouraged to move towards economy wide targets covering key mitigation sectors over time. Many of the countries have included energy efficiency plans in their NDC, which may provide a framework for national energy efficiency policies.

At this point, the Kigali Amendment to the MP allows countries to align mitigation actions in the Refrigeration, Air Conditioning and Freezer sectors with their targets under the MP and the Paris Agreement under the UNFCCC. **Reducing the consumption of HFCs and HCFCs could be combined with effective energy efficiency policies in the RAC&F sectors.** This would result in maximized climate benefits and early mitigation action that is needed to stay on an emissions pathway towards a global average temperature increase of well below 2°C.

The Kigali Amendment provides an opportunity to the parties to adopt energy-efficient, environment friendly appliances based on low-GWP refrigerant gases. The decision XXVIII/3 of the meeting of the parties to the Montreal Protocol recognizes that a phase-down of HFCs would present additional opportunities to catalyse and secure improvements in the energy efficiency of appliances and equipment.

## ***11.5. Assessment of alternate technologies***

With HCFC phase-out targets now being complied and new HFC phase-down under the Kigali amendment, manufacturers are currently assessing a number of substances as next generation alternatives, which are low GWP and zero ODP. A diverse range of alternatives is available today but to find the most suitable refrigerant for respective application, a comprehensive evaluation of all of the options is necessary.

Assessment of the alternative substances along with the best suited technology (i.e. product) for Maldives is the focus under this section as various parameters influence the decision making process. The aim is not simply to introduce the most efficient and environment friendly product in the market, but to strike the best balance among parameters such as availability of energy efficient appliances in the country which have environment friendly refrigerants, safety issues (flammability and toxicity) of the refrigerants, and environmental gains (ODP and GWP).

An analysis has been carried out in order to evaluate the performance of low-GWP alternative systems in high ambient conditions based on various reports published by Technology and Economic Assessment Panel (TEAP) of United Nations Environment Program (UNEP). According to TEAP, performance of these newly developed alternatives when compared with the HFCs and HFC blends is comparable across a number of parameters such as energy efficiency, system cost, environmental gains, availability, and technical feasibility, as demonstrated in table below:

**Domestic Air conditioning<sup>60</sup>** (at present the common substances used are R-407C (GWP 17741) R-410A (GWP 2088) HFC-32 (GWP 675)

Alternatives	Safety <sup>61</sup>		System cost	Energy efficiency	Environmental	
	Flammability	Toxicity			GWP	ODP
HC-290	3	A	Same as R-410A units	Equal or better efficiency than R-410A	3	0
R-441A	3	A	Not known	Not known	6	0
HFC-32	2L	A	Expected to be the same or below the price of R-410A units	Equal or better efficiency than R-410A	675	0
R-446A	2L	A2L	Not known	Not known	460	0
R-447A	2L	A2L	Not known	Not known	582	0

**Domestic Refrigeration** (at present the common refrigerant is HFC-134a which has GWP 1430)

Alternatives	Safety		System cost	Energy efficiency	Environmental	
	Flammability	Toxicity			GWP	ODP
HC-600a	3	A	After initial capital investments on-going costs are slightly reduced	Equal or better than HFC-134a	3	0
HFO-1234yf	2L	A	HFOs are more expensive than HFC-134a	Not known	4	0
HFO-1234ze	2L	A	HFOs are more expensive than HFC-134a	Not known	7	0

## ***11.6. Proposal for integration of climate change goals with S&L***

During the preliminary discussions for S&L in the Maldives **it has been proposed that the energy efficiency standards and labelling of appliances in Maldives could be so structured that it is linked with the HPMP and promotes those refrigerants /chemicals which are defined as zero ODP and low GWP substances.**

The S&L programme for air conditioners and refrigerators could be so defined that along with the information for energy efficiency the user is also informed about the type of refrigerant used in the product. Moreover, slowly the programme could facilitate in transition of controlled substances to the alternative substances which will have low GDP along with zero ODP.

There are a few proposals in this regard which are shared below:

- 1) Firstly, the existing regulations in the Maldives needs to be aligned with Kigali amendment which focusses on reduction of HFCs and identification of alternative substances.
- 2) Though the alternative substances are under various stages of development, the maximum rating for the energy efficiency label could be linked with the use of those alternative refrigerants which have low GWP,

<sup>60</sup> Information: UNEP Ozone Secretariat, workshop on HFC management: technical issues

<sup>61</sup> Safety related parameter is assessed based on ASHRAE classification ASHRAE34-2010



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zero ODP and also do not have safety concerns, while the business-as-usual refrigerants could be allowed lower ratings in the energy efficiency labelling band.

- 3) One of the options could be to first of all separately define a policy for promotion of substances with low GWP and zero ODP. The policy could differentiate between the business-as-usual refrigerants with the alternative substances through a code, colouring or any other form of visual mechanism. This could then be linked with S&L wherein the label can capture the details of type of refrigerants used in the appliances

## 12. Project review discussions

### Minutes of discussion between officials from LCEI project, MEA & PwC

Participants	Date and time	Medium
Mr. Mohamed Inaz, LCEI Project Manager, MEE	26 February 2018	WebEx call
Ms. Fathimath Raufa Moosa, LCEI Project M&E Officer, MEE	11:00 to 12:00 (MVT)	
Ms. Shara Mauroof Ahmed, S&L Officer, MEA		
Mr. Rajeev Ralhan, Director, PwC		
Mr. Mohit Verma, Manager, PwC		
Mr. Jwalant Mehta, Consultant, PwC		

A WebEx call was scheduled between the officials from LCEI Project – MEE, MEA and PwC on 26<sup>th</sup> February 2018. The agenda of the discussion was to **review the project's progress**.

A summary of key points discussed over the call is shared below.

- Mr. Mohit shared that the team has planned to review the relevant international programs for the three appliances, identify relevant case studies from which learnings for Maldives could be adopted, and analyze the past studies shared by MEE.
  - He further shared that review of programs in China, Singapore, Malaysia, Thailand, India and Hong Kong was almost complete and the team is currently moving forward with the detailed assessment.
  - He also shared that the case study on Fiji had been further elaborated. In addition, the team has also identified one more small country in South East Asia, as another relevant example for further details.
  - The team has completed the review of the studies shared by MEE during the inception stage, including the JICA manual, proposed labelling scheme in 2012, consumer awareness report, and market assessment report. Also, the responses received by the three importers have been analyzed.
- Mr. Rajeev then enquired about the expectations of MEA on the design of label for the S&L programme in the country. Mr. Inaz shared that the stakeholders are expecting a customized label for the Maldives capturing the local needs in the country. Mr. Mohit shared that the team is also in agreement that this is the ideal **approach, as directly adopting different countries' label design for a particular appliance and may be another design for a different appliance is not feasible.**
- Mr. Rajeev then proposed the approach to be followed for development of the labelling programme in the Maldives. He suggested that the ideal way forward should be to gain a consensus on the standards (energy) & other technical features first, and then the design aspects of the label could be decided. The design aspects include the rating system (bands, stars, ticks, grades, alphabets etc.), aesthetics of the label, languages used etc. He also emphasized on the need to define the size and placement of the label on the appliance.
- Mr. Inaz enquired about the ideal approach to determine the label design and other aspects for the labelling program, and the approach adopted in India. Mr. Rajeev shared that in India, a detailed stakeholder survey was conducted separately to arrive at the ideal design. The survey took into account factors such as relative ease of interpretation, appeal, simplicity, colouring scheme, suitable size, etc. before finalizing the five star rating band. Mr. Inaz requested that the PwC team share a preliminary indicative format of the survey, to which Mr. Rajeev agreed.
- Mr. Rajeev then enquired about the timelines of the deliverables preferred by MEE & MEA. One option involves the team to prepare the proposal for labelling programme for one appliance and share with MEE & MEA for comments. Post comments the final labelling programs for the 3 appliances could be proposed. The

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other approach involved submitting the programs for all 3 appliances together. Mr. Inaz requested Mr. Rajeev to share the proposed timelines. Mr. Rajeev replied that he would share it by email shortly.

- It was also shared that the minutes of the inception workshop is under review and the comments will be shared with PwC within a few days.
- Mr. Mohit requested the MEA and MEE for their support in gathering relevant information from the importers who have not filled the questionnaire so far or have provided very limited information.

**At the meeting's conclusion, the team thanked LCEI project and MEA personnel for their inputs and support.**

# Bibliography

1. “Maldives”, 13 February 2018 <<https://atlas.media.mit.edu/en/profile/country/mdv/>>
2. ADB, Maldives’ Energy Sector Assessment, 13 February 2018
3. “Maldives cuts electricity subsidies”, 14 February 2018 <<http://maldivesindependent.com/politics/maldives-cuts-electricity-subsidies-121777>>
4. National Energy Agency, 20 February 2018 <<http://www.nea.gov.sg>>
5. CLASP S&L database, 4 August 2017
6. Technical Analysis of Market to Develop Energy Efficiency Labels in Maldives, 2016
7. UAE.S 5010-2:2012 Labelling – Energy Efficiency for Electrical Appliances Part 2: Washing Machines and Dryers
8. “WELS products”, 20 February 2018 <<https://www.pub.gov.sg/wels/welsproducts>>
9. TGL-07-R3-14, “Green Label Product - Room Air Conditioner”
10. Tgl-3-R2-02, “Refrigerator”
11. BigEE, “Energy efficient washing machines – China”, 2014
12. “Code of Practice on Energy Labelling of Products”, Hong Kong, 2014
13. TGL-13-R1-07, “Washing Machines”
14. “Energy Efficiency Label No.5 Air Conditioner”, 14 February 2018, <<https://www.iea.org/policiesandmeasures/pams/thailand/name-155766-en.php>>
15. “The Energy Label – NEA”, 5 March 2018, <<http://www.nea.gov.sg/energy-waste/energy-efficiency/household-sector/the-energy-label>>
16. “Air Conditioners (India)”, 16 February 2018, <<http://www.bigee.net/en/country/in/appliances/#appliance13>>
17. Market research of Top10, January 2014
18. BigEE, “Washing Machines in China”, 2014
19. “WELS products”, 20 February 2018, <[www.pub.gov.sg/wels/welsproducts](http://www.pub.gov.sg/wels/welsproducts)>
20. “Standards & Labelling Program”, 5 March 2018, <<http://beestarlabel.com>>
21. BNERI, “Comparative Study On Energy Efficiency Ratings And Labelling For Air-Conditioners: Proposal For Brunei”, 2012
22. “Appliance Labelling And Standards In The Pacific Islands”, 23 February 2018, <[https://www.iea.org/media/workshops/2015/egrdoct/11Farrell\\_DTU.pdf](https://www.iea.org/media/workshops/2015/egrdoct/11Farrell_DTU.pdf)>
23. Renewable Energy & Energy Efficiency Partnership (REEEP), “Technical Analysis of Appliance Markets to Support The Pacific Appliance Labelling and Standards (PALS) Programme”, 2012
24. “MEPSL”, 5 March 2018, <<http://www.fdoe.gov.fj/index.php/energy-security/energy-conservation-efficiency/mepsl>>

25. "Refrigerator Programme in China", 25<sup>th</sup> February 2018, <<https://www.businesswire.com/news/home/20120920006790/en/CCID-Consulting-China%E2%80%99s-Home-Appliances-Market-Status>>
26. "Refrigerator market in China", 5<sup>th</sup> March 2018, IBIS World Research, 2017.
27. "Market share for refrigerators in China, 2011", 25<sup>th</sup> March 2017, <<https://www.businesswire.com/news/home/20120920006790/en/CCID-Consulting-China%E2%80%99s-Home-Appliances-Market-Status>>
28. "Freezer compartment rating", 5<sup>th</sup> March 2018, bbc.co.uk, skillwise, Star Ratings, 2011.
29. "Refrigerator rating in China", 5<sup>th</sup> March 2018, Wuppertal Institute for Climate, Environment and Energy, 2014.
30. "Refrigerator programme in Singapore", 5<sup>th</sup> March 2018, <<http://www.nea.gov.sg/energy-waste/energy-efficiency/household-sector/the-energy-label>>
31. "Grading scheme for refrigerators in Singapore", 5<sup>th</sup> March 2018, <<http://www.nea.gov.sg/>>
32. "Refrigerator programme in Malaysia", 5<sup>th</sup> March 2018, <<http://www.st.gov.my>>
33. "Refrigerator Market in Malaysia", 5<sup>th</sup> March 2018, REVIEW OF REFRIGERATOR ENERGY EFFICIENCY THRESHOLDS IN SELECTED ASIAN COUNTRIES, Energy Efficient strategies for the Australian Government, Final Report, Australia, April 2014.
34. "Refrigerator programme in Thailand", 5<sup>th</sup> March 2018, REVIEW OF REFRIGERATOR ENERGY EFFICIENCY THRESHOLDS IN SELECTED ASIAN COUNTRIES, Energy Efficient strategies for the Australian Government, Final Report, Australia, April 2014.
35. "Test Standard in Thailand", 5<sup>th</sup> March 2018, TIS 2186-2547 (2004).
36. "Refrigerator market in India", 5<sup>th</sup> March 2018, <: [https://www.edelresearch.com/showreportpdf-37397/CONSUMER\\_DURABLES\\_-\\_HOME\\_RUN-JUL-17-EDEL](https://www.edelresearch.com/showreportpdf-37397/CONSUMER_DURABLES_-_HOME_RUN-JUL-17-EDEL)>
37. "Star Rating Band for DCR", 5<sup>th</sup> March 2018, <<https://www.beestarlabel.com/Content/Files/DCR%20notification.pdf>>
38. "Star Rating Band for FFR", 5<sup>th</sup> March 2018, <<https://www.beestarlabel.com/Content/Files/FFRnoti.pdf>>
39. "Climate conditions in Maldives", 6<sup>th</sup> March 2018, <<https://www.climatestotravel.com/climate/maldives>>
40. "Climate conditions in China", 6<sup>th</sup> March 2018, <<https://www.travelchinaguide.com/climate/>>
41. "Climate conditions in Singapore", 6<sup>th</sup> March 2018, <<http://www.weather.gov.sg>>
42. "Climate conditions in Malaysia", 6<sup>th</sup> March 2018, <<http://www.holiday-weather.com/country/malaysia/>>
43. "Climate conditions in Thailand", 6<sup>th</sup> March 2018, <<http://www.plantsrescue.com/the-12-climate-regions/>>
44. "Climate conditions in India", 6<sup>th</sup> March 2018, <<http://www.plantsrescue.com/the-12-climate-regions/>>
45. "Climate conditions in Hong Kong", 6<sup>th</sup> March 2018, <[http://www.weather.gov.hk/cis/climahk\\_e.htm](http://www.weather.gov.hk/cis/climahk_e.htm)>

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46. "Climate conditions in UAE", 6<sup>th</sup> March 2018, <<https://www.climatestotravel.com/climate/united-arab-emirates>>

# Appendix A. - Questionnaires prepared for engagement with retailers

## A.1. Air conditioners

S. No.	Query	Response		
1	Segmentation of air conditioner import /sales in FY 2017 by type  <i>Kindly mention segmentation in terms of percentages</i>	Machine type	Percentage	
		Window type – fixed speed Split type – fixed speed Window type – variable speed Split type - variable speed		
2	Segmentation of window-type air conditioner sales in FY 2017 by capacity  <i>Kindly mention segmentation in terms of percentages</i>	Capacity range	Unit (BTU/h or ref. ton)	Percentage
		Upto 9000 9000 – 12000 12000 – 18000 18000 – 24000 24000+	BTU/h	
2	Segmentation of split-type air conditioner sales in FY 2017 by capacity  <i>Kindly mention segmentation in terms of percentages</i>	Capacity range	Unit (BTU/h or ref. ton)	Percentage
		Upto 9000 9000 – 12000 12000 – 18000 18000 – 24000 24000+	BTU/h	
3	From which countries are window type – fixed speed air conditioners imported (top 3 countries)?  <i>Kindly mention percentages</i>	Country	Percentage share for window type – fixed speed air conditioners	
4	From which countries are split type – fixed speed air conditioners imported (top 3 countries)?  <i>Kindly mention percentages</i>	Country	Percentage share for split type – fixed speed air conditioners	

5	From which countries are window type – variable speed air conditioners imported (top 3 countries)? <i>Kindly mention percentages</i>	Country	Percentage share for window type – variable speed AC
6	From which countries are split type – variable speed air conditioners imported (top 3 countries)? <i>Kindly mention percentages</i>	Country	Percentage share for split type – variable speed air conditioners
7	Are energy efficiency labels present on the air conditioner models sold in the Maldives? <i>If yes, kindly comment on the ratings (star levels) of air conditioners sold</i>		
8	What are the main purchasing criteria for a consumer while purchasing an air conditioner?  <i>Kindly mention ranking</i>	Criteria	Rank
		Price	
		Aesthetics	
		Energy consumption	
		ODP	
		Features	



## A.2. Refrigerator

S. No.	Query	Response		
1	Segmentation of refrigerator import /sales in FY 2017 by type  <i>Kindly mention segmentation in terms of percentages</i>	Machine type	Percentage	
		Absorption type Compression type		
2	Another way of segmentation of refrigerator import /sales in FY 2017 by type  <i>Kindly mention segmentation in terms of percentages</i>	Machine type	Percentage	
		Single door (direct cool)  Double door (frost free) with freezer section on the top  Three door  Side-by-Side (multi door)  Others.		
3	Segmentation of absorption-type refrigerator sales in FY 2017 by capacity (Gross Volume)  <i>Kindly mention segmentation in terms of percentages</i>	Capacity range (Gross volume in Litres)	Percentage	
		Less than 100 100 to 200 ...		
4	Segmentation of compression-type refrigerator sales in FY 2017 by capacity (Gross Volume)  <i>Kindly mention segmentation in terms of percentages</i>	Capacity range (Gross volume in Litres)	Percentage	
		Less than 100 100 to 200 ...		
5	Details of capacity of each type of refrigerator	Type	Gross volume in L	Percentage
		Single door (direct cool)	≤ 100	
			> 100 & ≤ 200	
			> 200 & ≤ 300	
			300 above	
		Double door (frost free) with freezer	≤ 200	
> 200 & ≤ 250				
> 250 & ≤ 300				

		section on the top	> 300 & ≤ 350	
			> 350 & ≤ 400	
			> 400 & ≤ 500	
			> 500	
		Three door		
		Side-by-Side (multi door)		
		Others		
6	From which countries are absorption-type refrigerators imported (top 3 countries)? <i>Kindly mention percentages</i>	Country	Percentage share for absorption-type refrigerators	
7	From which countries are compression-type refrigerators imported (top 3 countries)? <i>Kindly mention percentages</i>	Country	Percentage share for compression-type refrigerators	
8	Are energy efficiency labels present on the refrigerator models sold in the Maldives? <i>If yes, kindly comment on the ratings (star levels) of refrigerators sold</i>			
9	What are the main purchasing criteria for a consumer while purchasing a refrigerator?  <i>Kindly mention ranking</i>	Criteria	Rank	
		Price		
		Aesthetics		
		Energy consumption		
		ODP		
		Features		

## A.3. Washing machine

S. No.	Query	Response	
1	Segmentation of washing machine import /sales in FY 2017 by type  <i>Kindly mention segmentation in terms of percentages</i>	Machine type	Percentage
		Semi-automatic Top-loader Front-loader Washer-dryers	
2	Segmentation of washing machine sales in FY 2017 by capacity  <i>Kindly mention segmentation in terms of percentages</i>	Capacity range	Unit (kg or L)
		≤ 5	kg
		6 – 8	kg
...			
3	From which countries are semi-automatic machines imported (top 3 countries)?  <i>Kindly mention percentages</i>	Country	Percentage share for semi-automatic machines
4	From which countries are top-loaders imported (top 3 countries)?  <i>Kindly mention percentages</i>	Country	Percentage share for top-loaders
5	From which countries are front loaders imported (top 3 countries)?  <i>Kindly mention percentages</i>	Country	Percentage share for front loaders
6	From which countries are washer dryers imported (top 3 countries)?  <i>Kindly mention percentages</i>	Country	Percentage share for washer dryers
7	Are energy efficiency labels present on the washing machine models sold in the Maldives?  <i>If yes, kindly comment on the ratings (star levels) of washing machines sold</i>		
8		Criteria	Rank

<p>What are the main purchasing criteria for a consumer while purchasing a washing machine?</p> <p><i>Kindly mention ranking</i></p>	Price	
	Aesthetics	
	Energy consumption	
	Water consumption	
	Features	

# Appendix B. - Revised programs post stakeholder engagement

## B.1. Air conditioners

<b>Scope of the S&amp;L programme</b>	Single-phase single-split and unitary type air conditioners of both fixed speed and variable speed types, for household use including the rated capacities of upto 30000 Btu/hr.							
<b>Referred test standard</b>	ISO 5151:2010, for non-ducted air conditioners and heat pumps – Testing and rating performance Temperature bin distribution shall follow Table 3, ISO 16358-1 IEC 62301:2011, for standby power consumption							
<b>Terms and definitions</b>	<p>As per ISO 5151:2010</p> <ul style="list-style-type: none"> <li>• Cooling Seasonal Performance Factor (CSPF): ratio of total amount of heat the equipment can remove from indoor air when operated for cooling in active mode to the total annual amount of energy consumed by the equipment during the same period. Its unit is Wh/Wh</li> <li>• For fixed speed air conditioners, <math>CSPF = 1.062 \times EER_{tested}</math> at 100% capacity. Energy Efficiency Ratio (EER) is defined as ratio of total cooling capacity to effective power input at any given rating condition. Its unit is kW/kW</li> <li>• For inverter air conditioners, CSPF is calculated using the measured energy consumption during the tests</li> <li>• Standby mode: Lowest power consumption mode which cannot be switched off (influenced) by the user and that may persist for an indefinite time when an appliance is connected to the main electricity supply and used in accordance with the manufacturer's instructions</li> <li>• Standby power: Average power in standby mode when measured in accordance with the specified standard</li> </ul>							
<b>Testing guidelines</b>	As per ISO 5151:2010, ISO 16358-1 and IEC 62301:2011							
<b>Eligibility requirements for minimum coefficient of performance (MEPS)</b>	As per lowest energy efficiency rating level (Level 1)							
<b>Other eligibility requirements (if any)</b>	Refrigerant's ODP should be Zero							
<b>Rating scheme</b>	<table border="1" style="width: 100%; text-align: center;"> <tr> <td rowspan="2">Rating</td> <td>For ACs with cooling capacities &lt; 4.5 kW</td> <td>For ACs with cooling capacities between 4.5 kW and 7.1 kW</td> </tr> <tr> <td>Value of CSPF (Wh/Wh)</td> <td>Value of CSPF (Wh/Wh)</td> </tr> </table>			Rating	For ACs with cooling capacities < 4.5 kW	For ACs with cooling capacities between 4.5 kW and 7.1 kW	Value of CSPF (Wh/Wh)	Value of CSPF (Wh/Wh)
Rating	For ACs with cooling capacities < 4.5 kW	For ACs with cooling capacities between 4.5 kW and 7.1 kW						
	Value of CSPF (Wh/Wh)	Value of CSPF (Wh/Wh)						

	<b>Level 1 (lowest)</b>	< 3.10	< 2.90
	<b>Level 2</b>	3.10 – 3.30	2.90 – 3.10
	<b>Level 3</b>	3.30 – 4.60	3.10 – 4.00
	<b>Level 4</b>	4.60 - 5.30	4.00 - 5.10
	<b>Level 5 (highest)</b>	≥5.30	≥5.10

## B.2. Refrigerators

<b>Scope of the S&amp;L programme</b>	Compression-type Direct-Cool (single-door) refrigerators and Compression-type Frost-Free (double-door, three-door and side-by-side) refrigerators, intended for household use, including the rated capacities of 100l-650l.
<b>Referred test standard</b>	ISO15502 test procedure (or IEC 62552 edition 1)
<b>Terms and definitions</b>	<p>As per ISO15502 test procedure (or IEC 62552 edition 1):</p> <ul style="list-style-type: none"> <li>• <b>Refrigerating appliance</b> is a factory-assembled insulated cabinet with one or more compartments and of suitable volume and equipment for household use, cooled by natural convection or a frost-free system whereby the cooling is obtained by one or more energy-consuming means.</li> <li>• <b>Refrigerator</b> is a refrigerating appliance intended for the preservation of food, one of whose compartments is suitable for the storage of fresh food.</li> <li>• <b>Compression-type refrigerating appliance</b> is a refrigerating appliance in which refrigeration is effected by means of a motor-driven compressor.</li> <li>• <b>Absorption-type refrigerating appliance</b> is a refrigerating appliance in which refrigeration is effected by an absorption process using heat as energy source.</li> <li>• <b>Refrigerator-freezer</b> is a refrigerating appliance having at least one compartment suitable for the storage of fresh food (the fresh-food storage compartment) and at least one other (the food freezer compartment) suitable for the freezing of fresh food and the storage of frozen food under three-star storage conditions.</li> <li>• <b>Frost-free refrigerator-freezer</b> is a refrigerator-freezer in which all compartments are automatically defrosted with automatic disposal of the defrosted water and at least one compartment is cooled by a frost-free system.</li> <li>• <b>Direct cool refrigerator-freezer</b> is a refrigerator-freezer in which all compartments are manually defrosted with manual disposal of the defrosted water.</li> <li>• The <b>energy consumption test</b> is the test for the energy consumption by the refrigeration appliance at an ISO tropical temperature of either 16°C or 32°C. <b>Energy consumption is calculated as:</b>  <math display="block">E_x = E_1 + (E_2 - E_1) \times (t_x - t_1) / (t_2 - t_1)</math> <ul style="list-style-type: none"> <li>t1 = measured compartment temperature for point 1</li> <li>t2 = measured compartment temperature for point 2</li> <li>t<sub>x</sub> = target temperature for the compartment for energy consumption determination</li> <li>E1 = measured energy consumption of the appliance at point 1</li> <li>E2 = measured energy consumption of the appliance at point 2</li> <li>E<sub>x</sub> = calculated energy consumption of the appliance at the target temperature t<sub>x</sub>.</li> </ul> </li> </ul> <p><b>For the given conditions, t<sub>x</sub> = 32°C and E<sub>x</sub> = E32.</b></p> <ul style="list-style-type: none"> <li>• <b>Calculation of V<sub>adj</sub></b> – The adjusted volume of a refrigerator shall be calculated through the following formula:</li> </ul>

$V_{adj} = \Sigma(K_c \times \text{Actual volume of the compartment})$   
 $K_c$  is the volume correction factor for a particular type of compartment and is defined as follows:

Compartment Type	Volume Correction Factor ( $K_c$ )
Fresh Food	1.00
4 star freezer	1.79
3 star freezer	1.79
2 star freezer	1.57
1 star freezer	1.36
Chill	1.13
Cellar	0.75

**Testing guidelines**

As per ISO15502 test procedure (or IEC 62552 edition 1)

**Eligibility requirements for minimum coefficient of performance (MEPS) requirements**

Type	Annual Energy Consumption (AEC) in kwh
	MEPS level
Without freezer	$[(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.551] \geq \text{AEC} > [(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.461]$
With freezer ( $V_{adj} \text{ tot} \leq 300$ litres)	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.553] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.427]$
With freezer ( $V_{adj} \text{ tot} > 300$ and $\leq 900$ litres)	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.506] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.427]$
With freezer, through-the-door ice dispenser	$[(585 + 1.378 \times V_{adj} \text{ tot}) \times 0.485] \geq \text{AEC} > [(585 + 1.378 \times V_{adj} \text{ tot}) \times 0.409]$

**Other eligibility requirements (if any)**

Refrigerant's ODP should be zero

**Rating scheme**

Type	Annual Energy Consumption (AEC) in kwh				
	Level 1	Level 2	Level 3	Level 4	Level 5
Without freezer	Not Applicable	$[(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.551] \geq \text{AEC} > [(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.461]$	$[(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.461] \geq \text{AEC} > [(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.332]$	$[(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.332] \geq \text{AEC} > [(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.239]$	$[(368 + 0.892 \times V_{adj} \text{ tot}) \times 0.239] \geq \text{AEC}$
With freezer ( $V_{adj} \text{ tot} \leq 300$ litres)	Not Applicable	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.553] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.427]$	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.427] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.312]$	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.312] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.228]$	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.228] \geq \text{AEC}$
With freezer ( $V_{adj}$ )	Not Applicable	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.506] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.427]$	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.427] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.312]$	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.312] \geq \text{AEC} > [(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.228]$	$[(465 + 1.378 \times V_{adj} \text{ tot}) \times 0.228] \geq \text{AEC}$



	tot > 300 and ≤ 900 litres)		0.506] ≥ AEC > [(465 + 1.378 x Vadj tot) x 0.427]	tot) x 0.427] ≥ AEC > [(465 + 1.378 x Vadj tot) x 0.312]	tot) x 0.312] ≥ AEC > [(465 + 1.378 x Vadj tot) x 0.228]	<b>0.228] ≥</b> AEC
	With freezer, through-the- door ice dispenser	Not Applicable	[(585 + 1.378 x Vadj tot) x <b>0.485] ≥</b> AEC > [(585 + 1.378 x Vadj tot) x 0.409]	[(585 + 1.378 x Vadj tot) x <b>0.409] ≥</b> AEC > [(585 + 1.378 x Vadj tot) x 0.298]	[(585 + 1.378 x Vadj tot) x <b>0.298] ≥</b> AEC > [(585 + 1.378 x Vadj tot) x 0.218]	[(585 + 1.378 x Vadj tot) x <b>0.218] ≥ AEC</b>

## B.3. Washing machines

<b>Scope of the S&amp;L programme</b>	All residential washing machines, including automatic and semi-automatic, with horizontal axis (front loaders or vertical axis (top loaders) with a capacity of upto 14 kg																																																					
<b>Referred test standard</b>	<ul style="list-style-type: none"> <li>IEC 60456 for front loaders</li> <li>JIS 9606 for top loaders</li> </ul>																																																					
<b>Programme referred</b>	<ul style="list-style-type: none"> <li>Standard cotton 60 degree Celsius for front loaders</li> <li>As prescribed by JIS 9606 for top loaders</li> </ul>																																																					
<b>Terms and definitions</b>	All definitions as per IEC 60456 for front loaders and JIS 9606 for top loaders																																																					
<b>Testing guidelines</b>	<ul style="list-style-type: none"> <li>Test procedure – as described in IEC 60456 for front loaders, JIS 9606 for top loaders</li> <li>Test parameters – wash performance, rinse performance, spin extraction performance, water consumption per cycle, energy consumption per cycle</li> </ul>																																																					
<b>Eligibility requirements for minimum qualification (MEPS)<sup>62</sup></b>	<ul style="list-style-type: none"> <li>Water consumption – 28 L/kg for top loaders, 12 L/kg for front loaders</li> <li>Wash performance – 80% for top loaders, 103% for front loaders</li> <li>Water extraction efficiency (RMC) ≤ ___% for Top loaders (test as per JIS 9606)</li> <li>Water extraction efficiency (RMC) ≤ ___% for Front loaders (test as per IEC 60456)</li> </ul>																																																					
<b>Other requirements (if any)</b>	None																																																					
<b>Rating scheme</b>	<table border="1"> <thead> <tr> <th rowspan="2">EE Level</th> <th colspan="3">Top load (impeller type)</th> <th colspan="3">Front load (drum type)</th> </tr> <tr> <th>Electricity use (max) kWh per cycle per kg</th> <th>Water use (max) L per cycle per kg</th> <th>Cleaning performance (min)</th> <th>Electricity use (max) kWh per cycle per kg</th> <th>Water use (max) L per cycle per kg</th> <th>Cleaning performance (min)</th> </tr> </thead> <tbody> <tr> <td><b>Level 5 (highest)</b></td> <td>0.011</td> <td>14</td> <td>0.90</td> <td>0.11</td> <td>7</td> <td>1.03</td> </tr> <tr> <td><b>Level 4</b></td> <td>0.012</td> <td>16</td> <td>0.80</td> <td>0.13</td> <td>8</td> <td>1.03</td> </tr> <tr> <td><b>Level 3</b></td> <td>0.015</td> <td>20</td> <td>0.80</td> <td>0.15</td> <td>9</td> <td>1.03</td> </tr> <tr> <td><b>Level 2</b></td> <td>0.017</td> <td>24</td> <td>0.80</td> <td>0.17</td> <td>10</td> <td>1.03</td> </tr> <tr> <td><b>Level 1 (lowest)</b></td> <td>0.022</td> <td>28</td> <td>0.80</td> <td>0.19</td> <td>12</td> <td>1.03</td> </tr> </tbody> </table>						EE Level	Top load (impeller type)			Front load (drum type)			Electricity use (max) kWh per cycle per kg	Water use (max) L per cycle per kg	Cleaning performance (min)	Electricity use (max) kWh per cycle per kg	Water use (max) L per cycle per kg	Cleaning performance (min)	<b>Level 5 (highest)</b>	0.011	14	0.90	0.11	7	1.03	<b>Level 4</b>	0.012	16	0.80	0.13	8	1.03	<b>Level 3</b>	0.015	20	0.80	0.15	9	1.03	<b>Level 2</b>	0.017	24	0.80	0.17	10	1.03	<b>Level 1 (lowest)</b>	0.022	28	0.80	0.19	12	1.03
EE Level	Top load (impeller type)			Front load (drum type)																																																		
	Electricity use (max) kWh per cycle per kg	Water use (max) L per cycle per kg	Cleaning performance (min)	Electricity use (max) kWh per cycle per kg	Water use (max) L per cycle per kg	Cleaning performance (min)																																																
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<b>Level 1 (lowest)</b>	0.022	28	0.80	0.19	12	1.03																																																

<sup>62</sup> **Note for water extraction efficiency:** The value for water extraction efficiency has been kept blank in the above framework. The value needs to be arrived based on the performance data of washing machines that are being brought in the Maldives. It is suggested that, to begin with MEA shall introduce the programme without minimum requirement for water extraction efficiency. During the programme implementation phase, MEA shall sought the test report for the washing machines which shall have the information on water extraction efficiency. A database shall be developed for water extraction efficiency values and based on this the MEA shall incorporate a prescribed minimum value for water extraction efficiency in consultation with stakeholders.

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**Ministry of Environment**

# Development and Implementation of Standards and Labelling Programme in the Maldives

*EE labelling programme implementation  
procedure – Task 3*

Strengthening Low Carbon  
Energy Island Strategies (LCEI) Project



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# 1. Process of implementing Maldives EE labelling programme

## 1.1. Introduction

The implementation of energy efficiency S&L programme requires an efficient working mechanism between the importers / manufacturers / dealers of appliances and the officials of the MEA and MCS. The recommended EE labelling programme covers 3 appliances: air conditioners, refrigerators and washing machines.

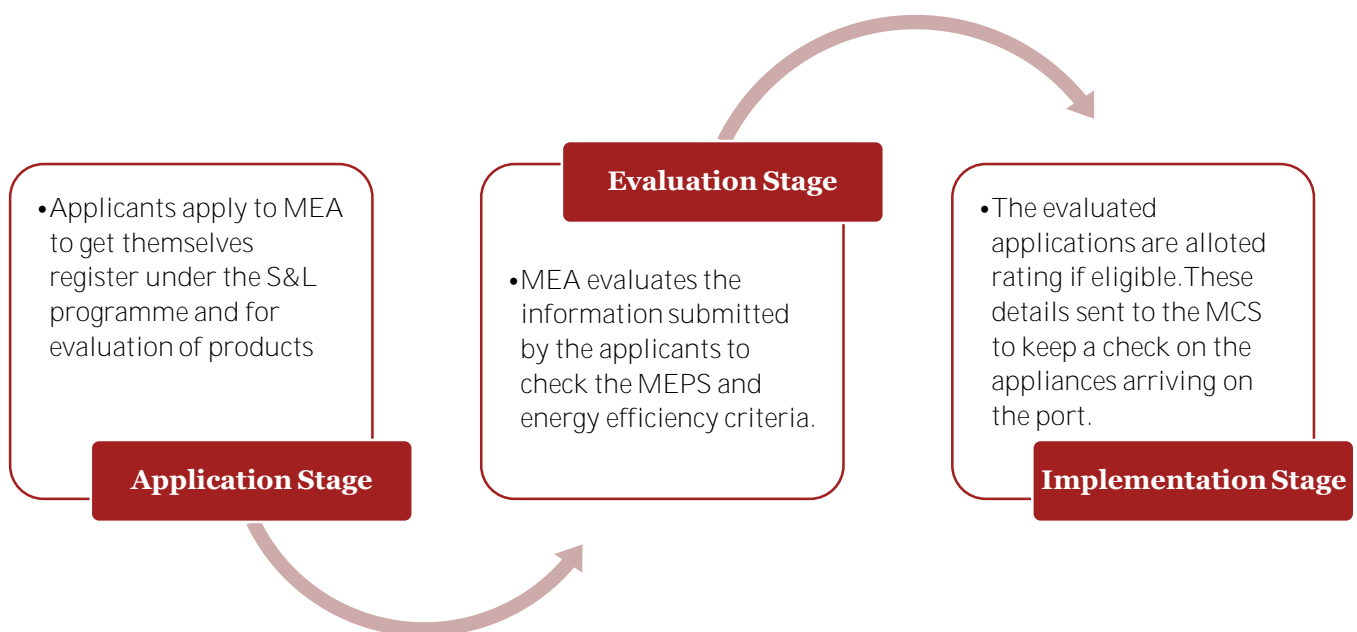
The proposed implementation of energy efficiency programme for these 3 appliances is to be done in a sequential process.

The first stage will be the **application stage**, in which the applicant, who wants to import /export electrical appliances into the Maldives will fill out the forms touted by the MEA. The importers, international manufacturers, and dealers are considered as the applicants. They shall submit their applications to MEA for seeking permission to affix the energy label on their product models. These forms shall ask certain set of details, such as general details about the appliance, performance of the appliance, lab tests conducted, energy standards and test standards followed. These details shall be duly filled by the applicants.

On receipt of duly filled forms from the applicants, the MEA shall record and store the details mentioned in the forms in an initial database. MEA shall then evaluate the technical details using an evaluation tool to verify whether the appliances are as per the standards as specified by the information provided by the applicant or not. They also verify whether they follow the EE standards as developed for the Maldives or not. This stage is called the **evaluation stage**.

After the verification, the information about the approval or rejection of the appliances, and the label grade in which they fall shall be sent to the respective applicant and also stored in a modified database, controlled by the MEA. The copy of this information shall be sent to the MCS, so that when the products arrive at the port, using these details, the MCS can allow and/or confiscate the approved and rejected appliances. This final stage is the **implementation stage**.

Figure 1: Sequential process to implement EE programme for the selected appliances in the Maldives





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## 1.2. Key definitions

**Family of model of an appliance:** Family of models is the range of product models of one particular brand, to which a single set of test reports specifically for product's energy performance parameters, is applicable and where each of the model has the same relevant physical characteristics, comparative energy consumption, same energy efficiency rating, and performance characteristics. The term 'model' is synonymous with 'family of models'

For e.g.: A certain model of refrigerator from a brand is present in the market with some variations in the colour, pattern or certain other visual features however the performance of all such models is same. The model with the highest value of Annual Energy Consumption (in kWh/yr) amongst them shall be considered the parent model, and all other variations shall come under this family of model.

**Applicant organization:** Applicant organization refers to the organization that is applying to MEA for seeking permission /approval for affixing energy efficiency label of a particular grade on its product models. This application is for the purpose of registration of products models under the S&L programme in the Maldives. The applicant organization can be an importer, a dealer registered in the Maldives or a manufacturer or an exporter outside Maldives.

**Name of the authorized representative:** This refers to the name of the person who is an authorized signatory in the Applicant's organization and has been assigned the authority to submit the application to MEA on behalf of the organization. This representative shall fill the required details duly on the forms required, on the behalf of the applicant organization.

**Proposed grading level:** This refers to the energy efficiency grading level that has been proposed by the Applicant for a particular product model.

**Database:** A database is a structured set of organized data, which can be accessed by the users having the access to that particular database.

**Administrator:** The administrator or the admin refers to the person who has the access to read, write as well as append a particular database. In this case, the admin shall be an MEA official.

**Label:** Label is a form of written matter, printed, marked, stamped or graphic affixed to, or appearing upon the appliance

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## 1.3. Application stage

This stage refers to the steps based on which the applicant may be able to submit a certain set of details, related to the organization and the products, so that MEA can record the information as a database and process the information to categorize the products into a specific label grade.

The applicant and the MEA act as joint custodians for this particular stage.

It is the responsibility of the applicant to submit the required details to the MEA in the prescribed formats, which are floated by the MEA. There are three forms that are being floated by the MEA:

- I. **Cover letter** shall be attached to the application providing a summary of details entered in the application. The template of **cover letter is attached in Appendix A.**
- II. **Form-1**, asking the details about the registration of applicant for Energy Efficiency Labelling Program. The applicant is asked about the details of the organization, authorized representative and the appliances to be registered by the applicant.
- III. **Form-2**, asking general details about the organization of applicant. The applicant is expected to fill product model details to be registered.
- IV. **Form-3** asking the details about the model test results, to be submitted by the applicant as a test report from accredited test labs. It is the responsibility of the applicant to get this form duly filed.

The template of **Form 1, 2 and 3 is attached in Appendix B, C and D for air conditioner, refrigerator and washing machine respectively.**

**The applicant shall be required to submit test report for each model, family of model declaration, company registration certificate and trademark certificate along with the 3 forms as supporting document.**

### 1.3.1. Details in Form-1

This is the form wherein the applicant registers its organization and the concerned contact person with the MEA. The applicant declares the appliances (Air conditioner and/or Refrigerator and/or Washing Machine) it wants to register for energy efficiency label of Maldives.

### 1.3.2. Details in Form-2

This is the form wherein the applicant shall register the product models for the energy label. including its performance details (fetched from test reports) and proposed energy efficiency grade. The information included in this form shall include but not limited to the following:

- Name of the applicant organization
- Address and contact details of the applicant organization
- Name of the authorized representative
- Address and contact details of the authorized representative
- Product Model information
  - Brand
  - Model no.
  - Family of model
  - Product Type
  - Technical details for a particular appliance

The applicant fills these forms and submits to the MEA, with a cover letter attached to it.<sup>1</sup>

### 1.3.3. Details in Form-3

The applicant shall submit the test results of the model in the format specified in the form to MEA for evaluation of the application:

- General particulars about the test lab where the appliance has been tested
- Date of receipt of samples by the lab
- Date on which the tests have been performed
- Product type
- Test results as per the prescribed format and conducted as per the standards and tests mentioned in the respective form of each appliance.

### 1.3.4. Creation of database

Using these details recorded in the forms, an initial database, called the **Application Stage Database** is created, saved and regularly updated. This database shall contain the details of applications submitted to MEA via forms in a consolidated manner.

### 1.3.5. Code for the MEA to keep track of the applications

The MEA needs to keep a track of the applications that is submitted for several appliances by the applicants. For the same, a unique **application no.** can be allotted to every application, so that using this no. as a label ticker, detail for a particular application can be fetched as and when required. This can be done as follows:

**Step-1:** The forms are duly filled by the applicant.

**Step-2:** The filled forms are sent by the applicant to the MEA on a particular date. This information is stored in the created database as follows (To avoid bias towards any brand name and model name, they have been coded as B1 and B1M2 respectively.):

Sl. No.	Date of receipt of application	Application No.	Applicant Name	Type of appliance	Brand	Model number	Type	Information on family of model
1	16-May-18		Applicant 1	Air Conditioner	B1	B1M1	Inverter	

**Step-3:** MEA can use the date of receipt of application and model no. to formulate the application number, which shall be unique, as it uses a specific date and a model no., which will always be unique. Therefore, the application no. can be coded as ddMMMyB1M1. This shall be included in the table as follows:

Sl. No.	Date of receipt of application	Application No.	Applicant Name	Type of appliance	Brand	Model number	Type	Information on family of model
1	16-May-18	ddMMMyB1M1	Applicant 1	Air Conditioner	B1	B1M1	Inverter	

Thus, a unique application no. for every appliance is created.

<sup>1</sup> Sample cover letter format displayed in **Appendix-A**.

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## 1.4. Evaluation stage

MEA evaluates the model performance data submitted by the applicants. The application is first checked for **minimum qualification criteria of the label**. If the conditions are satisfied, then the applicant's model is allotted a rating level based on the energy efficiency grading criteria.

The MEA is the sole custodian of this stage. The evaluation is done based upon specific technical parameters of a particular appliance, using a tool designed for the purpose.

### 1.4.1. Scrutinizing the database after the consolidation

The consolidated information in the database is verified with the initial information sent by the applicant. This data is scrutinized further to check the following:

- **Whether the data is complete or not:** To check this, all the cells are duly checked by the administrator of the database. If some information is missing in a particular cell, it is cross checked from the original information provided by the applicant. In case, the information is incomplete, the applicant shall be informed of the same and the processing of respective application is kept on-hold until the required details are submitted.
- **Whether the data is non-redundant or not:** If the data in two or more than two particular rows or columns is redundant, the information shall be evaluated whether multiple applicants are providing application for same model of a particular brand? If so, then the initial approval shall be referred to process the applications
- **Errors in database creation:** Before evaluating the technical specifications of the product model through evaluation tool, the database shall be cross checked for any potential error that might happen in feeding the details in data by the administrator.

### 1.4.2. The evaluation tool

In this stage, the database that has been consolidated in the application stage is evaluated based upon the technical parameters to identify whether the appliances that are being proposed for import are as per the EE standards in the Maldives or not. This is done in the sheet named as **Evaluation Tool**.

The administrator of the tool needs to input the required technical details in the input sections. The final grade allotted by the tool is displayed in Result Table. For reference, the administrator can use the reference tables.

### 1.4.3. Procedure to use the evaluation tool

The evaluation tool is used as follows:

- The general information and technical test details are filled corresponding to each column in the table titled as **Application Stage Database** in the tool.
- After consolidation of the details filled in the Application Stage, the table in **Evaluation Stage** gets updated as per the energy label criteria of the appliance and **Rating for the applicant's model** get proposed simultaneously.
- The final grade allotted for that particular appliance and model submitted by an applicant is calculated by the tool and displayed in the **Result** table.
- This process is repeated for every appliance to be evaluated.

## 1.5. Snapshot of steps to be taken by MEA for appliance EE labelling

### 1.5.1. Process flow for air conditioners

Following is the process flow for refrigerators:

**Step-1:** Creation of initial database using the information provided by the applicant.

Figure 2: Illustrative representation of Application Stage database for air conditioners.

APPLICATION STAGE DATABASE													
Sl. No.	Date of receipt of application	Application No.	Applicant Name	Type of appliance	Brand	Model number	Type	Information on family of model	Capacity (kW)	Input power (Watts)	Refrigerant's ODP	Standby Power	Tested CSPF (Wh/Wh)
1	16-May-18	A1	Applicant 1	Air Conditioner	B1	B1M1	Inverter		4		0		4.00
2	16-May-18	A2	Applicant 1	Air Conditioner	B1	B1M2	Inverter		4.5		0		3.30
3	16-May-18	A3	Applicant 2	Air Conditioner	B2	B2M1	Inverter		7.1		0		5.60
4	16-May-18	A4	Applicant2	Air Conditioner	B3	B3M1	Inverter		5.6		0		2.00
5	16-May-18	A5	Applicant 2	Air Conditioner	B4	B4M1	Fixed speed		8		0		4.50
6	16-May-18	A6	Applicant 3	Air Conditioner	B4	B4M2	Fixed speed		3		0.5		3.00

**Step-2:** Use the evaluation tool to evaluate the label grade in which the appliance falls.

- In the General Details table, general description about the appliance is to be filled.
- In the table specified for particular technical details, fill in the respective values.
- Use the reference tables if required.
- Check the final grade allotted to the appliance in the Result table.
- Repeat the same process for every application tested.

Figure 3: Illustrative representation for Evaluation Tool for air conditioners.

Sl. No.	Applicati on No.	Brand	Model number	Capacity (kW)	Input power (Watts)	Refrigerant's ODP	Standby Power	Tested CSPF (Wh/Wh)	Rating proposed
1	A1	B1	B1M1	4	0	0	0.00	4.00	Approved: Rating Allotted: 3-star
2	A2	B1	B1M2	4.5	0	0	0.00	3.30	Approved: Rating Allotted: 3-star
3	A3	B2	B2M1	7.1	0	0	0.00	5.60	Approved: Rating Allotted: 5-star

4	A4	B3	B3M1	5.6	0	0	0.00	2.00	Approved: Rating Allotted: 1-star
5	A5	B4	B4M1	8	0	0	0.00	4.50	Not Applicable: AC capacity (kW) beyond scope of label.
6	A6	B4	B4M2	3	0	0.5	0.00	3.00	Application Rejected: Refrigerant's ODP is non-zero.

CSPF value (minimum)		
<4.5 kW	4.5 to 7.1 kW	Code
0	0	1-star
3.1	2.9	2-star
3.3	3.1	3-star
4.6	4	4-star
5.3	5.1	5-star

**Step-3:** Updating the initial database with the rating allotted and application status.

*Figure 4: Illustrative representation of implementation stage database for air conditioners.*

RESULT DATABASE											
Si. No.	Date of receipt of application	Application No.	Applicant Name	Type of appliance	Brand	Model number	Type	Information on family of model	Last Updated On	Result	Checked by
1	16-May-18	A1	Applicant 1	Air Conditioner	B1	B1M1	Inverter	0	16-May-18	Approved: Rating Allotted: 3-star	Official 1
2	16-May-18	A2	Applicant 1	Air Conditioner	B1	B1M2	Inverter	0	16-May-18	Approved: Rating Allotted: 3-star	Official 1
3	16-May-18	A3	Applicant 2	Air Conditioner	B2	B2M1	Inverter	0	16-May-18	Approved: Rating Allotted: 5-star	Official 1
4	16-May-18	A4	Applicant 2	Air Conditioner	B3	B3M1	Inverter	0	16-May-18	Approved: Rating Allotted: 1-star	Official 1
5	16-May-18	A5	Applicant 2	Air Conditioner	B4	B4M1	Fixed speed	0	16-May-18	Not Applicable: AC capacity (kW) beyond scope of label.	Official 1
6	16-May-18	A6	Applicant 3	Air Conditioner	B4	B4M2	Fixed speed	0	16-May-18	Application Rejected: Refrigerant's ODP is non-zero.	Official 1

### 1.5.2. Process flow for refrigerators

Following is the process flow for refrigerators:

**Step-1:** Creation of initial database using the information provided by the applicant.

Figure 5: Illustrative representation of Application Stage database for refrigerators.

APPLICATION STAGE DATABASE														
SI. No.	Application No.	Applicant Name	Brand	Model	Type	Family of model	Fresh food	1-star freezer	Chill	Cellar	Refrigerant ODP	Refrigerant GWP	Year of make	Annual Energy Consumption (kWh/year)
1	A1	Applicant 1	B1	B1M1	Refrigerator-freezer		652	0	0	0	0	0	2015	748
2	A2	Applicant 2	B1	B1M2	Refrigerator-freezer		550	0	0	0	0	0	2019	562
3	A3	Applicant 3	B2	B2M1	Refrigerator-freezer		401	0	0	0	0	0	2018	398
4	A4	Applicant 4	B3	B3M1	Refrigerator-freezer		249	0	0	0	0	0	2019	292
5	A5	Applicant 5	B4	B4M1	Refrigerator only		70	0	0	0	0	0	2018	168
6	A6	Applicant 6	B4	B4M2	Refrigerator only		115	0	0	0	0	0	2019	500

**Step-2:** Use the evaluation tool to evaluate the label grade in which the appliance falls.

- In the General Details table, general description about the appliance is to be filled.
- In the table specified for particular technical details, fill in the respective values.
- Use the reference tables if required.
- Check the final grade allotted to the appliance in the Result table.
- Repeat the same process for every application tested.

Figure 6: Illustrative representation of Evaluation Tool for refrigerators.

GENERAL DETAILS		Reference Table-1	
Application No.	A1	<b>Compartment type</b>	<b>Correction factor</b>
Brand name	B2	Fresh Food	1
Model no.	B2M1	4 star freezer	1.79
Type	Refrigerator-freezer	3 star freezer	1.79
Information updated on	16-May-20	2 star freezer	1.57
Refrigerant ODP	0	1 star freezer	1.36
Refrigerator Type	Refrigerator without freezer	Chill	1.13
Freezer Type	4 star freezer	Cellar	0.75
Storage volume (in L)	550		
Volume of refrigeration cabinet (in L)	450		
Volume of freezer cabinet (in L)	100		

Correction factor for the freezer	1.79
Total adjusted volume (in L)	629

ANNUAL ENERGY CONSUMPTION FROM THE TEST				Reference Table-2
Grades	Lower Limit	Derived AEC (in kWh/yr)	Upper Limit	Types of Refrigerators
2 Star	428.30	230.00	511.92	Refrigerator without freezer Refrigerator with freezer, Adjusted Volume ≤ 300l Refrigerator with freezer, 300l < Adjusted Volume ≤ 900l Refrigerator with freezer and TTD dispenser
3 Star	308.45		428.30	
4 Star	222.05		308.45	
5 Star	0		222.05	

Result	
Application Status / Rating	Approved; Rating Allotted: 3 Star

**Step-3:** Updating the initial database with the rating allotted and application status.

Figure 7: Illustrative representation of Implementation Stage database for refrigerators.

RESULT DATABASE											
Sl. No.	Date of receipt of application	Application No.	Applicant Name	Brand	Model	Type	Family of model	Year of make	Last Updated On	Application Status / Rating	Verified by
1	16-Mar-20	A1	Applicant 1	B1	B1M1	Refrigerator - freezer		2015	16-Mar-20	Application Rejected: MEPS requirements not satisfied.	Official 1
2	17-Mar-20	A2	Applicant 2	B1	B1M2	Refrigerator - freezer		2019	17-Mar-20	Approved: Rating Allotted: 2 Star	Official 1
3	18-Mar-20	A3	Applicant 3	B2	B2M1	Refrigerator - freezer		2018	18-Mar-20	Approved: Rating Allotted: 3 Star	Official 1
4	19-Mar-20	A4	Applicant 4	B3	B3M1	Refrigerator - freezer		2019	19-Mar-20	Approved: Rating Allotted: 3 Star	Official 1
5	20-Mar-20	A5	Applicant 5	B4	B4M1	Refrigerator only		2018	20-Mar-20	Approved: Rating Allotted: 3 Star	Official 1
6	21-Mar-20	A6	Applicant 6	B4	B4M2	Refrigerator only		2019	21-Mar-20	Application Rejected: MEPS requirements not satisfied.	Official 1



### 1.5.3. Process flow for washing machines

Following is the process flow for refrigerators:

**Step-1:** Creation of initial database using the information provided by the applicant.

- In the General Details table, general description about the appliance is to be filled.
- In the table specified for particular technical details, fill in the respective values.
- Use the reference tables if required.
- Check the final grade allotted to the appliance in the Result table.
- Repeat the same process for every application tested.

Figure 8: Illustrative representation of Application Stage database for washing machines.

APPLICATION STAGE DATABASE												
Sl. No.	Date of receipt of application	Application No.	Applicant Name	Brand	Model	Year of Manufacturer	Information on family of model	Capacity (kg)	Type	Electricity consumption KWh/cycle/kg	Water consumption L/cycle/kg	Wash performance (%)
1	16-Mar-20	A1	Applicant 1	B1	B1M1	2019		6	Front Load (Drum Type)	0.186	11.31	1.12
2	17-Mar-20	A2	Applicant 2	B1	B1M2	2019		6	Front Load (Drum Type)	0.168	9.71	1.08
3	18-Mar-20	A3	Applicant 3	B2	B2M1	2019		6	Front Load (Drum Type)	0.094	5.35	1.04
4	19-Mar-20	A4	Applicant 4	B3	B3M1	2019		7	Top Load (Impeller Type)	0.029	14.41	0.95
5	20-Mar-20	A5	Applicant 5	B4	B4M1	2019		15	Top Load (Impeller Type)	0.012	15.30	0.83
6	21-Mar-20	A6	Applicant 6	B4	B4M2	2019		14	Top Load (Impeller Type)	0.008	10.98	0.92

**Step-2:** Using the evaluation tool to evaluate the label rating in which the appliance falls.

Figure 9: Evaluation tool for washing machines.

GENERAL DETAILS		Electricity use (max) kWh per cycle per kg from the test				
		Lower Limit for Front Loader	Lower Limit for Top Loader	Electricity use (max) kWh per cycle per kg	Upper Limit for Front Loader	Upper Limit for Top Loader
Application No.	A6	0.17	0.017	0.008	0.19	0.022
Brand name	B4	0.15	0.015		0.17	0.017
Model no.	B4M2	0.13	0.012		0.15	0.015
Year of Manufacturer	2019	0.11	0.011		0.13	0.012
Information updated on	23-May-18	0.00	0.000		0.11	0.011
Washing Machine Type	Top Loader (Impeller Type)					
Capacity (kg)	14					
Electricity use (max) kWh per cycle per kg	0.01					
Water use (max) L per cycle per kg	10.90					

Cleaning Performance (Min) 0.90

**Water use (max) L per cycle per kg from the test**

Rating	Lower Limit for Front Loader	Lower Limit for Top Loader	Water use (max) L per cycle per kg	Upper Limit for Front Loader	Upper Limit for Front Loader
Star 1	10	24		12	28
Star 2	9	20		10	24
Star 3	8	16		9	20
Star 4	7	14		8	16
Star 5	0	0	10.92	7	14

**Reference Table-1**

**Types of washing machines**

Front Loader (Drum type)  
Top Loader (Impeller type)

**Cleaning Performance (Min) from the test**

Rating	Lower Limit for Front Loader	Lower Limit for Top Loader	Cleaning Performance (Min)	Upper Limit for Front Loader	Upper Limit for Front Loader
Star 1	1.03	0.80		N.A.	0.90
Star 2	1.03	0.80		N.A.	0.90
Star 3	1.03	0.80		N.A.	0.90
Star 4	1.03	0.80		N.A.	0.90
Star 5	1.03	0.90	0.90	N.A.	N.A.

**RESULT**

**Application Status / Overall Rating**

**Approved; Rating Allotted: Star 5**

**Step-3:** Updating the initial database with the rating allotted and application status.

Figure 10: Implementation stage database for washing machines.

RESULT DATABASE													
Sl. No.	Date of receipt of application	Application No.	Applicant Name	Type of appliance	Brand	Model	Year of Manufacturer	Information on family of model	Capacity (kg)	Type	Last Updated On	Result	Checked by
1	16-Mar-20	A1	Applicant 1	Washing Machine	B1	B1M1	2019		6.000	Front Load (Drum Type)	16-Mar-20	Approved; Rating Allotted: Star 1	Official 1
2	17-Mar-20	A2	Applicant 2	Washing Machine	B2	B2M2	2019		6.000	Front Load (Drum Type)	17-Mar-20	Approved; Rating Allotted: Star 2	Official 1
3	18-Mar-20	A3	Applicant 3	Washing Machine	B3	B3M1	2019		6.000	Front Load (Drum Type)	18-Mar-20	Approved; Rating Allotted: Star 5	Official 1
4	19-Mar-20	A4	Applicant 4	Washing Machine	B4	B4M1	2019		7.000	Top Load (Impeller Type)	19-Mar-20	Application Rejected: Electricity use MEPS requirements not satisfied.	Official 1
5	20-Mar-20	A5	Applicant 5	Washing Machine	B5	B5M1	2019		15.000	Top Load (Impeller Type)	20-Mar-20	Not Applicable: Washing Machine capacity (kg) beyond scope of label.	Official 1
6	21-Mar-20	A6	Applicant 6	Washing Machine	B6	B6M2	2019		14.000	Top Load (Impeller Type)	21-Mar-20	Approved; Rating Allotted: Star 5	Official 1

## ***1.6. Implementation stage***

The implementation stage is the final stage of application process for the 3 appliances. This refers to the approval given to the applicant for affixing EE label on the appliances that have been approved for EE labelling.

After the data is scrutinized in the evaluation stage, the final database is created for keeping a record on the EE labelled appliances that are to be imported/exported into the Maldives by the applicants. The approval/rejection is conveyed to the applicant, stating that the respective appliance model as applied by the applicant for EE labelling comes under the regulations of the MEA, and that the following can/cannot be imported into the Maldives.

The MEA, acting as the custodian for this particular stage, confirms the approval and/ or rejection of the appliance to the applicant. The applicant then initiates the process to import the approved appliances to the Maldives.

The updated database is stored with additional columns such as Rating allotted and Approval status.

Simultaneously, the MEA also sends a copy of the details of the approved appliances to the MCS, so that MCS is aware of the products and the parameters based on which the imported products are required to be checked.

### ***1.6.1. Data provided to the applicant for the approval/rejection***

Following data is provided to the applicant to inform them about the approval:

1. Application no.
2. Type of appliance
3. Brand
4. Model
5. Type
6. Result, as follows
  - Approved – Rating is allotted
  - Rejected – Reason of rejection is provided – Beyond capacity/ Not meeting ODP requirements/ Not meeting MEPS requirement

This data is fetched from the final database.

### ***1.6.2. Methods of providing approval/rejection to the applicant***

Following are the ways to inform the applicant about the approval of the appliances:

#### ***Confirmation through e-mail***

The approval can be sent to the applicant through an e-mail as follows:

**To: [Insert recipient name]**

**Subject: Approval status for the appliances to be imported to Maldives as per the details submitted by [Insert organization name]**

**Date: [Insert date]**

Dear **[insert recipient name]**,

We understand that your organization had sent us the details of the appliances that you want to be imported into the Maldives. Following is the status for the approval of the appliances along with the star rating allotment:

Brand	Model No.	Type	Result
B1	B1M1	Refrigerator freezer	Approved; Rating Allotted: 2 Star
B1	B1M2	Refrigerator freezer	Approved; Rating Allotted: 3 Star
B2	B2M1	Refrigerator freezer	Approved; Rating Allotted: 4 Star
B3	B3M1	Refrigerator freezer	Approved; Rating Allotted: 5 Star
B4	B4M1	Refrigerator only	Rejected: MEPS requirements not satisfied.
B4	B4M2	Refrigerator only	Rejected: ODP requirements not satisfied.

Therefore, MEA hereby approves import of the appliances into the Maldives across which the result status reads **Approved** and denies the imports of the appliance, for which the status reads **Rejected**. MEA permits the applicant to use only the corresponding star rating allotted against approved model listed above.

We believe that this is an important step toward achieving higher standards of energy efficiency, which would benefit the citizens of the Maldives and increase the trading of energy-efficient products further.

Regards,

**Maldives Energy Authority  
Ministry of Environment  
Republic of Maldives**

*Letter of approval/rejection to the applicant*

The approval/rejection can be sent to the applicant through a letter as follows:

Following can be the structure of the sample letter written by MEA to another labelling authority:

**Maldives Energy Authority  
Ameenee Magu, Maafannu, 20392,  
Male, Republic of Maldives**

**[Insert date]**

**[Insert recipient name]**

**[Insert recipient title]**

**[Insert recipient organization name]**

**[Insert recipient address]**

**[Insert recipient suburb/town, state, country and postcode]**

Dear **[insert recipient name]**,

We understand that your organization had sent us the details of the appliances that you want to be imported into the Maldives. Following is the status for the approval of the appliances:

Brand	Model No.	Type	Result
B1	B1M1	Refrigerator freezer	Approved
B1	B1M2	Refrigerator freezer	Approved
B2	B2M1	Refrigerator freezer	Approved

B3	B3M1	Refrigerator freezer	Approved
B4	B4M1	Refrigerator only	Approved
B4	B4M2	Refrigerator only	Rejected

Therefore, MEA hereby approves the import of the appliances into the Maldives across which the result status reads **Approved** and denies the imports of the appliance, for which the status reads **Rejected**.

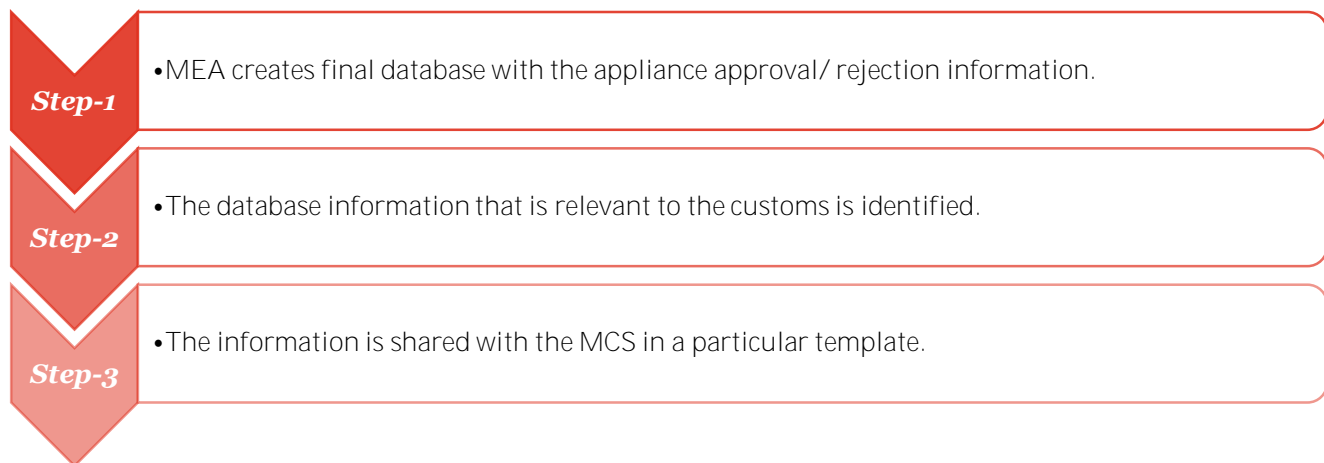
We believe that this is an important step toward achieving higher standards of energy efficiency, which would benefit the citizens of the Maldives and increase the trading of energy-efficient products further.

Regards,

**Maldives Energy Authority**  
**Ministry of Environment**  
**Republic of Maldives**

### 1.6.3. Providing information to the MCS for the approved energy label

*Process flow to provide the MCS information about the approval*



### *Template for the MCS to give approval for the imported products*

Following shall be the template in which the information shall be shared with the MCS:

Si. No.	Application No.	Applicant Name	Type of appliance	Brand	Model	Information on family of model	Capacity (kg)	Type	Electricity consumption KWh/cycle/kg	Water consumption L/cycle/kg	Cleaning performance	Result
1	A1	Applicant1	Washing Machine	B1	B1M1	Series M	0.000	Front Load (Drum Type)	0.186	11.31	1.12	Star 1
2	A2	Applicant2	Washing Machine	B2	B2M1	Series M	0.000	Top Load (Impeller Type)	0.029	14.41	0.95	Disqualified

## 1.7. Overall timeline for application processing

Procedure	Timeline (Working days)		Responsibility
Submission of details by the applicant	—	T	Applicant
Processing the details provided by the applicant to store the information in the initial application database created	2-3 days from the submission of the details by the applicant	T + 3	MEA
Evaluating the appliance using the technical parameters	3 days from the creation of the initial database	T + 6	MEA
Sending the copy of the same to the MCS	1-2 days from the evaluation of the technical details of the appliance	T + 8	MEA
Informing the applicant about the approval/ rejection of the appliances	1-2 days from sending the copy to the MCS	T + 10	MEA

The estimated timeline for overall application processing is about 8 - 10 working days starting from the date of submission of application by the applicant. However, the timeline is an indicative assessment considering the resources with MEA for the S&L programme have been recruited and the team is gradually expanding along with the increase in uptake of EE labelling programme.

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## ***2. Process and approach for establishing collaborative arrangement with international EE labelling authorities***

The EE labelling programme in the Maldives has been formulated based upon an exhaustive review and assessment of international labelling programmes reason being the market for appliances in the Maldives is completely import driven. The strategy to align EE labelling programme in the Maldives with the most applicable international EE labelling programme amongst the source countries will facilitate local stakeholders in faster adoption of policy measures and will also promote uptake of high efficient products in the country. However, the energy efficiency labelling framework formulated at present would need to undergo revisions from time to time to allow innovative products enter the market with high efficiency grade and also to phase-out obsolete technologies. Internationally, the EE labelling programmes are designed such that the standards are revised from time to time as well as the methodology for various aspects within the programme so that the overall process aligns with the pace of market advancements. Thus, it would be important for the MEA to connect with international EE labelling authorities to seek relevant information as per the programmatic framework.

Also, in the previous chapter a detailed process for implementation of EE labelling programme has been discussed. One of the important components is the information to be disclosed by the applicants on approval for affixing energy label received by them from international energy efficiency labelling authorities respectively for each appliance type. Thus, connecting and collaborating with international EE labelling authorities will be useful for MEA.

The collaboration with the labelling authorities is also needed so that during the period of voluntary labelling phase, the Maldives Customs Service is well aware of the products that might possibly be entering into the Maldives, and can be prepared in a more suitable ways to stop the counterfeit products.

This chapter provides an overview of the international energy efficiency labelling authorities and the process /approach to be adopted by MEA for collaborative arrangements.

### ***2.1. Brief overview of energy efficiency labelling authorities of key exporting countries***

#### ***2.1.1. National Environment Agency, Singapore<sup>2</sup>***

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<b>Particulars</b>	<b>Details</b>
Incorporation	It is an autonomous government agency. The organization is a statutory board under the Ministry of Environment and Water Resources, Singapore
Contact information	Address: 40 Scotts Road, #13-00 Environment Building, Singapore 228231 Contact number: +65 62255632 Website: <a href="http://www.nea.gov.sg/">http://www.nea.gov.sg/</a>

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<sup>2</sup> Source: <http://www.nea.gov.sg/> as retrieved on 5<sup>th</sup> June 2018.

Regulated household appliances as on May 2018

- Single-phase non-ducted room air-conditioner (not being second-hand goods) having a cooling capacity of:
  - ✓ 8.8 kW or lower, in the case of casement or window type air-conditioner;
  - ✓ 17.6 kW or lower, in the case of split type (inverter) air-conditioner; or
  - ✓ 17.6 kW or lower, in the case of split type (non-inverter) air-conditioner.
- Single-phase refrigerator (not being second-hand good) with an adjusted volume of up to 900 litres
- Single-phase clothes dryer (not being second-hand good) having a rated capacity of up to 10 kilograms
- Single-phase television (not being second-hand good)
- Single-phase lamp (not being second-hand goods)
- Single-phase clothes dryer means an assembly consisting of:
  - ✓ a rotating drum in which textile material is dried by tumbling; and
  - ✓ a heating device, which electrically heats the air used for drying the textile material in the rotating drum

### **2.1.2. China National Institute of Standardization, China<sup>3</sup>**

<b>Particulars</b>	<b>Details</b>
Incorporation	Established in 1963 and is a national research body. The organization is direct subordinate to General Administration of Quality Supervision, Inspection & Quarantine (AQSIQ)
Contact information	Address: No.4 Zhi Chun Road, Haidian District, Beijing, 100088 (CHINA) Contact number: +86 010-58811400 Website: <a href="http://en.cnis.gov.cn">http://en.cnis.gov.cn</a> Email: <a href="mailto:yulm@cnis.gov.cn">yulm@cnis.gov.cn</a>
Regulated household appliances as on May 2018	<ul style="list-style-type: none"><li>• Refrigerator</li><li>• Room Air Conditioner</li><li>• Washing machine</li><li>• Electric rice cooker</li><li>• Flat panel Television</li><li>• Colour Television</li><li>• Electric fan</li><li>• Variable speed Air Conditioner</li><li>• Electric water heater</li><li>• Gas instantaneous water heater</li><li>• Induction cooker</li><li>• Microwave oven</li></ul>

<sup>3</sup> Source: <http://en.cnis.gov.cn/> as retrieved on 5<sup>th</sup> June 2018.



### 2.1.3. Suruhanjaya Tenaga, Malaysia<sup>4</sup>

Particulars	Details
Incorporation	A statutory body under the Energy Commission Act, 2001, Government of Malaysia
Contact information	Address: Energy Commission, No. 12, Jalan Tun Hussein, Precinct 2, 62100, Putrajaya, Malaysia. Contact number: (603) 8870 8500 Website: <a href="http://www.st.gov.my/index.php/en/">http://www.st.gov.my/index.php/en/</a>
Regulated household appliances as on May 2018	<ul style="list-style-type: none"> <li>• Refrigerator</li> <li>• Air conditioner</li> <li>• Television (Plasma, LCD, LED, CRT)</li> <li>• Domestic fan</li> <li>• Compact Fluorescent Lamp (CFL)</li> <li>• LED lamp</li> <li>• Computer monitors</li> </ul>

### 2.1.4. Bureau of Energy Efficiency, India<sup>5</sup>

Particulars	Details		
Incorporation	Established on March 1, 2002. It is an autonomous statutory body. The organization comes under the Ministry of Power, Government of India		
Contact information	Address: Bureau of Energy Efficiency, 4th Floor, Sewa Bhawan, R. K. Puram, New Delhi - 110066 (INDIA) Contact number: +91 11 26179699 Website: <a href="http://beestarlabel.com">http://beestarlabel.com</a>		
Regulated household appliances as on May 2018	<table border="0"> <tr> <td style="vertical-align: top;"> <p>Mandatory regulated appliances</p> <ul style="list-style-type: none"> <li>• Room Air Conditioners</li> <li>• Frost Free Refrigerators</li> <li>• Tubular Florescent Lamp</li> <li>• Distribution Transformer</li> <li>• Room Air Conditioner (Cassettes, Floor Standing)</li> <li>• Direct Cool Refrigerator</li> <li>• Color Television</li> <li>• Electric Geysers</li> <li>• Variable Capacity Inverter Air conditioners</li> </ul> </td> <td style="vertical-align: top; padding-left: 20px;"> <p>Voluntarily regulated appliances</p> <ul style="list-style-type: none"> <li>• Induction Motors</li> <li>• Pump Sets</li> <li>• Ceiling Fans</li> <li>• LPG- Stoves</li> <li>• Washing Machine</li> <li>• Computer(Notebooks/ Laptops)</li> <li>• Ballast (Electronic/ Magnetic)</li> <li>• Office equipment's ( Printer, Copier, Scanner, MFD's )</li> <li>• Diesel Engine Driven Mono-set Pumps</li> </ul> </td> </tr> </table>	<p>Mandatory regulated appliances</p> <ul style="list-style-type: none"> <li>• Room Air Conditioners</li> <li>• Frost Free Refrigerators</li> <li>• Tubular Florescent Lamp</li> <li>• Distribution Transformer</li> <li>• Room Air Conditioner (Cassettes, Floor Standing)</li> <li>• Direct Cool Refrigerator</li> <li>• Color Television</li> <li>• Electric Geysers</li> <li>• Variable Capacity Inverter Air conditioners</li> </ul>	<p>Voluntarily regulated appliances</p> <ul style="list-style-type: none"> <li>• Induction Motors</li> <li>• Pump Sets</li> <li>• Ceiling Fans</li> <li>• LPG- Stoves</li> <li>• Washing Machine</li> <li>• Computer(Notebooks/ Laptops)</li> <li>• Ballast (Electronic/ Magnetic)</li> <li>• Office equipment's ( Printer, Copier, Scanner, MFD's )</li> <li>• Diesel Engine Driven Mono-set Pumps</li> </ul>
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<sup>4</sup> Source: <http://www.st.gov.my/> as retrieved on 5<sup>th</sup> June 2018.

<sup>5</sup> Source: <https://beeindia.gov.in/> as retrieved on 5<sup>th</sup> June 2018.

- LED Lamps
- Solid State Inverter
- DG Sets

### ***2.1.5. Department of Alternative Energy Development & Efficiency, Thailand<sup>6</sup>***

<b>Particulars</b>	<b>Details</b>
Incorporation	Established in 1953. It is a government agency under Ministry of Energy, Government of Thailand.
Contact information	Address: Ministry of Energy, 17 Rama 1 Rd, Kasatsuk Bridge, Pathumwan, Bangkok 10330 (THAILAND) Contact number: +662 223 0021 - 9 Website: <a href="http://weben.dede.go.th/">http://weben.dede.go.th/</a>
Regulated household appliances as on May 2018	<ul style="list-style-type: none"> <li>• Refrigerator</li> <li>• Air conditioner</li> <li>• Three phased motors</li> <li>• Linear Fluorescent Lamps</li> <li>• CFLs</li> <li>• Low loss magnetic ballasts</li> <li>• Electric fans</li> <li>• Electric rice cookers</li> <li>• Lighting fixtures</li> <li>• Oscillating fans</li> <li>• TVs (standby power)</li> <li>• Computer monitors (standby power)</li> </ul>

## ***2.2. Defining the expectations from collaborative arrangement between MEA and relevant international EE labelling authorities***

The overall functioning and implementation of EE labelling programme in Maldives if slightly supported by the collaborative arrangement between MEA and international EE labelling authorities, can be useful for faster uptake of programme in the country. However, such collaborative arrangement shall be formed based on certain scope. The expectations shall be pre-defined so that the organizations could progress in the positive manner.

Before discussing the expectations under collaborative arrangement, it is first of all essential to appreciate the fact that each of those countries which has implemented S&L has designed the programme in a manner which is most suitable to their local needs. Though the objective and nature of energy efficiency standards and labelling programme is similar in countries across the world however in each country the programme has been customized to suite local conditions and expectations of the stakeholders. It is therefore important to note that the collaborative arrangement between EE labelling authorities of multiple countries shall be formed in a manner which restricts the flow of information confidential for each country and also builds the trust of local consumers.

<sup>6</sup> Source: <http://weben.dede.go.th/webmax/> as retrieved on 5<sup>th</sup> June 2018.

Some of the key expectations from collaborative arrangement between MEA and relevant international EE labelling authorities:

- The relevant international EE labelling authorities are informed about the programme formulated in Maldives by the MEA
- The information about revisions brought-up under the energy standards for appliances covered under the labelling programme is shared as and when it is done (which are relevant for both /multiple countries)
- Most of the international EE labelling authorities provides information about the products covered under the labelling regime on their online web portal. This information is for public view for the viewers to make them aware about the products covered and respective energy efficiency grade. In the beginning this information will be useful for MEA to keep a check on the applications where the applicants are declaring information about approval received from other labelling authorities. The MEA is likely to inform the international EE labelling authorities for being an active viewer of the information on labelling products.

### ***2.3. Process for establishing collaborative arrangement between MEA and relevant international EE labelling authorities***

The possibilities for establishing a collaborative arrangement for MEA:

- MEA directly collaborates with international EE labelling authorities for the expectations listed above. This can be done using:
  - ✓ An official letter to other labelling authorities.
  - ✓ Followed by the letter, regular communication via e-mail.
  - ✓ Using the data available in the public domain.
- MEA, in coordination with ME shall seek the support from the corresponding foreign ministries to sign a MoU, which might include a collaborative arrangement on EE labelling of appliances.

#### ***2.3.1. Direct collaboration of the MEA with labelling authorities***

The direct collaboration of MEA with the international labelling authorities shall include an official letter to the authorities, followed by regular communication.

##### **A draft template of the letter to international EE labelling authorities by MEA**

In the letterhead of **Maldives Energy Authority**

**[Insert date]**

**[Insert recipient name]**

**[Insert recipient title]**

**[Insert recipient organization name]**

**[Insert recipient address]**

Dear [insert recipient name],

We understand that your organization is responsible for the management and maintenance of energy efficiency, particularly standards and labelling of the regulated electrical appliances in [insert country name].

The Maldives Energy Authority (MEA) is an independent regulatory organization affiliated to the Ministry of Environment and operates under the guidance of a governing board. The mandate of this agency is as follows.

- Providing advice to relevant government organizations regarding energy, and assisting in decision-making in this sector.
- Setting the standards and operating the regulations for the administration and monitoring of this sector according to government policy on energy.
- Developing the regulatory code and standards on the production and use of energy in the Maldivian context, and developing and administering the regulations for the provision of energy efficiency in the Maldives.
- Setting the standards for the electrical appliances that are imported into or sold in the Maldives.
- Issuing permits to parties that wish to import/ export electrical appliances into the Maldives, setting up the system of fees for the services provided by such parties, issuing permits to such parties, and monitoring such parties to ensure adherence to relevant regulations.
- Monitoring the statistics on the production and usage of energy in the Maldives, ascertaining the energy efficiency requirements of the nation, and gathering data, researching and disseminating information on this issue.

The MEA is setting up an energy efficiency standards and labelling programme for electrical appliances, particularly air conditioners, refrigerators and washing machines.

Given the import-driven nature of our market for these appliances and the fact that a significant share of these appliances is from [insert country name], we request your support in setting up and implementing the labelling programme [for these three appliances].

In particular, we wish to collaborate on the following aspects:

- The information about revisions brought-up under the energy standards for appliances covered under the labelling programme is shared as and when it is done (which are relevant for both countries)
- The information about the products covered under the labelling regime on the online web portal of respective implementing entity is allowed to be viewed and analysed.

We believe that this is an important step toward achieving higher standards of energy efficiency, which would benefit the citizens of the Maldives and increase the trade relations between our countries further.

Your assistance in this programme will be greatly valued by the people of the Maldives.

This collaborative arrangement period is now entered into force and will continue to be so until and unless terminated by either party through formal communication.

Looking forward for your support.

Sincerely,

**Maldives Energy Authority**  
**Ministry of Environment**  
**Republic of Maldives**

The MEA can also collaborate directly by using the information as put out by the labelling authority in public domain.

Almost every major international labelling authority has put a detailed summary of its appliances in the public domain in form of a database, which can be exported into an excel sheet, filtered or used as per the requirement.

*Figure 11: Information about the appliance available on the NEA, Singapore website<sup>7</sup>*

**Search Results**

Your search returned 477 results of Refrigerator Export 

Brand	Model	Type	Green Ticks	Volume (L)	Annual Energy Consumption (kWh) <sup>1</sup>	Annual Energy Cost (\$) <sup>2</sup>	Date Of Expiry
Akira	RS-128GK	Refrigerator only	2	89	207	56	29 Dec 2018
Akira	RS-155GK	Refrigerator only	2	120	212	57	30 Aug 2019
Ariston	ASSNI573HGS	Refrigerator freezer	2	557	566	153	27 Mar 2021
Beko	RDNT360I50VZX, RDNT360I50VZWB	Refrigerator freezer	2	321	339	92	19 Oct 2019
Beko	RDNT440E50VZX, RDNT440E50VZWB	Refrigerator freezer	2	392	412	111	16 Nov 2019
Beko	RDNT470E50VZX, RDNT470E50VZWB	Refrigerator freezer	2	422	467	126	16 Nov 2019
Beko	GN1416221ZX	Refrigerator freezer	1	541	668	180	22 Aug 2020
Beko	ASD241S	Refrigerator freezer	1	554	675	182	28 Aug 2019
Beko	ASL141B, ASL141S, ASL141W, ASL141X	Refrigerator freezer	1	558	679	183	28 Aug 2019
Beko	ASN541X	Refrigerator freezer	1	544	657	177	28 Aug 2019
Beko	CN151120X	Refrigerator freezer	2	460	537	145	28 Aug 2019
Beko	CNE47520GW, CNE47520GB	Refrigerator freezer	1	437	599	162	28 Aug 2019
Beko	DN156220JX	Refrigerator freezer	1	500	558	151	28 Aug 2019
Beko	DNE26020S	Refrigerator freezer	1	219	380	103	28 Aug 2019
Beko	RDNE350K20X	Refrigerator freezer	1	311	434	117	28 Aug 2019
Beko	RDNE420K20ZX	Refrigerator freezer	2	367	453	122	28 Aug 2019
Beko	RDNE455E30ZX	Refrigerator freezer	2	406	475	128	29 Aug 2019
Beko	RDNE455K20ZX	Refrigerator freezer	2	406	475	128	29 Aug 2019
Beko	TSE1283, TSE1283X	Refrigerator freezer	2	114	234	63	29 Aug 2019
Beko	RDNT230I50VZP	Refrigerator freezer	2	201	310	84	09 Oct 2019

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## 2.4. Use of information received from international EE labelling authorities by MEA

MEA can use the data available in public domain. A few of the probable areas where this information will be useful in the beginning:

- The information provided by the international labelling authorities can be used to compare the energy efficiency of two or more appliances (as it is done in other countries).
- The EE grade allotted by the international labelling authorities (specifically, from the labelling programme has been referred in the Maldives) can be used to refer the information submitted by the applicants which are submitting Form 1.
- Learning areas can be summarized based on overall programme management of international labelling authorities which will facilitate MEA in successfully implementing the S&L.

<sup>7</sup> Source: <https://e-services.nea.gov.sg/els/Pages/Search/PublicSearchProduct.aspx?param=goods&type=p> as retrieved on 7<sup>th</sup> June 2018.

## ***3. Process and procedure for importing the products into the country and process for custom officials to approve the imports***

The Maldives Customs Service (MCS) is most important stakeholder of the standards and labelling programme in Maldives. Maldives Customs Service (MCS) was established as a separate legal entity independent of the Civil Service under the Maldives Customs Act which was ratified on 11 May 2011. MCS is responsible for carrying out all necessary activities pertaining to customs in relation to import and export of goods to and from the Maldives and to maintain all the concerned accounts. MCS is also responsible for operating and managing activities of collecting import duties and export duties.

### ***3.1. Major procedures performed while importing the products into the Maldives***

The major procedures that are performed while importing any product into the Maldives are as follows:

#### **A. Registration under customs**

1. To perform the following functions, the entities shall be registered under Customs (a registration number is given):
  - To operate bonded warehouse
  - To give service of Customs broker
  - To operate as shipping agent
  - To give service of local courier agent
  - To import goods to Maldives
  - To export goods from Maldives
  - To operate duty free shops

#### **B. Declaration of goods**

1. Import of goods into the Maldives:
  - The parties permitted by the Ministry of Economic Development can import goods to the Maldives.
  - The permit provided by the Ministry of Economic Development shall be provided to Customs for the purpose of goods importation. The goods imported for commercial use shall be consigned under the name of the above permit holder.
2. Usage of registry numbers while importing the goods:
  - Importers shall use the registry number provided by customs in dealings with customs.
3. Submission of information on imported goods: The following documents shall be submitted with the goods declaration:
  - Commercial invoice
  - Packing list
  - Bill of lading or Airway bill
  - Documents stating the costs borne by the buyer and the seller stated in the Pre-valuation form
  - Insurance Policy for insured goods
  - Bond receipt or Post Waybill for goods imported through post
  - Courier Airway Bill or Delivery Order for goods imported through courier service
  - Documents stating all the costs incurred for the goods to be brought to the clearing Customs port
  - Documents stating the payment details or how the payment is to be made for the goods
  - Pro-forma invoice or the purchase order

- Any agreement made in writing between the buyer and the seller
- Itemized list of prices for spares, components, machineries in case the prices are given in aggregates for such goods
- Original of Certificate of Origin, if preferential rate of duty is claimed
- Permits from relevant government authorities for goods requiring such permit for importation
- Any other information regarding the imported goods, which the importer wants to share with Customs

4. Information to be included in the invoice:

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>• Item name</li> <li>• Item number</li> <li>• Quantity</li> <li>• Unit</li> <li>• Brand (for branded goods)</li> <li>• Model (for goods with models)</li> <li>• Part number or Code number (for goods with such numbers)</li> <li>• Size of the goods</li> </ul> | <ul style="list-style-type: none"> <li>• Item packing</li> <li>• Country of origin</li> <li>• Year of production or vintage (for liquor products)</li> <li>• Condition of goods</li> <li>• Period of usage for pre-used goods</li> <li>• Unit price</li> <li>• Total price</li> </ul> |
|---|---|

5. Information to be included in the packing list:

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>• Detail of the goods</li> <li>• Package type</li> <li>• Total number of packages</li> <li>• Package number</li> <li>• Details of the goods in each package</li> </ul> | <ul style="list-style-type: none"> <li>• Total number of packages in the shipment</li> <li>• Weight and cubic meters of the goods in the shipment</li> </ul> |
|---|--|

6. Mandatory information to be included in the bill of lading:

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>• Bill of Lading or Airway Bill number</li> <li>• Full name and address of the exporter</li> <li>• Full name and address of the consignee</li> <li>• Port of loading</li> </ul> | <ul style="list-style-type: none"> <li>• Port of discharge</li> <li>• Container number or Seal number</li> <li>• Shipping mark</li> <li>• Type of goods</li> <li>• Total weight and Cubic meter</li> </ul> |
|--|--|

### **C. Valuation of goods**

As per the Customs Act and General Regulation, for all Customs purposes, the value of the goods shall be determined in accordance with **the relevant Sections of the World Trade Organization (WTO)’s “Agreement on Implementation of Article VII of the General Agreement on Tariff and Trade 1994)”**.

**Information regarding the World Trade Organization (WTO)’s “Agreement on Implementation of Article VII of the General Agreement on Tariff and Trade 1994)” and Decisions made in accordance with the Agreement shall be made available on the Customs website and from all Customs Offices.**

### **D. Post clearance audit**

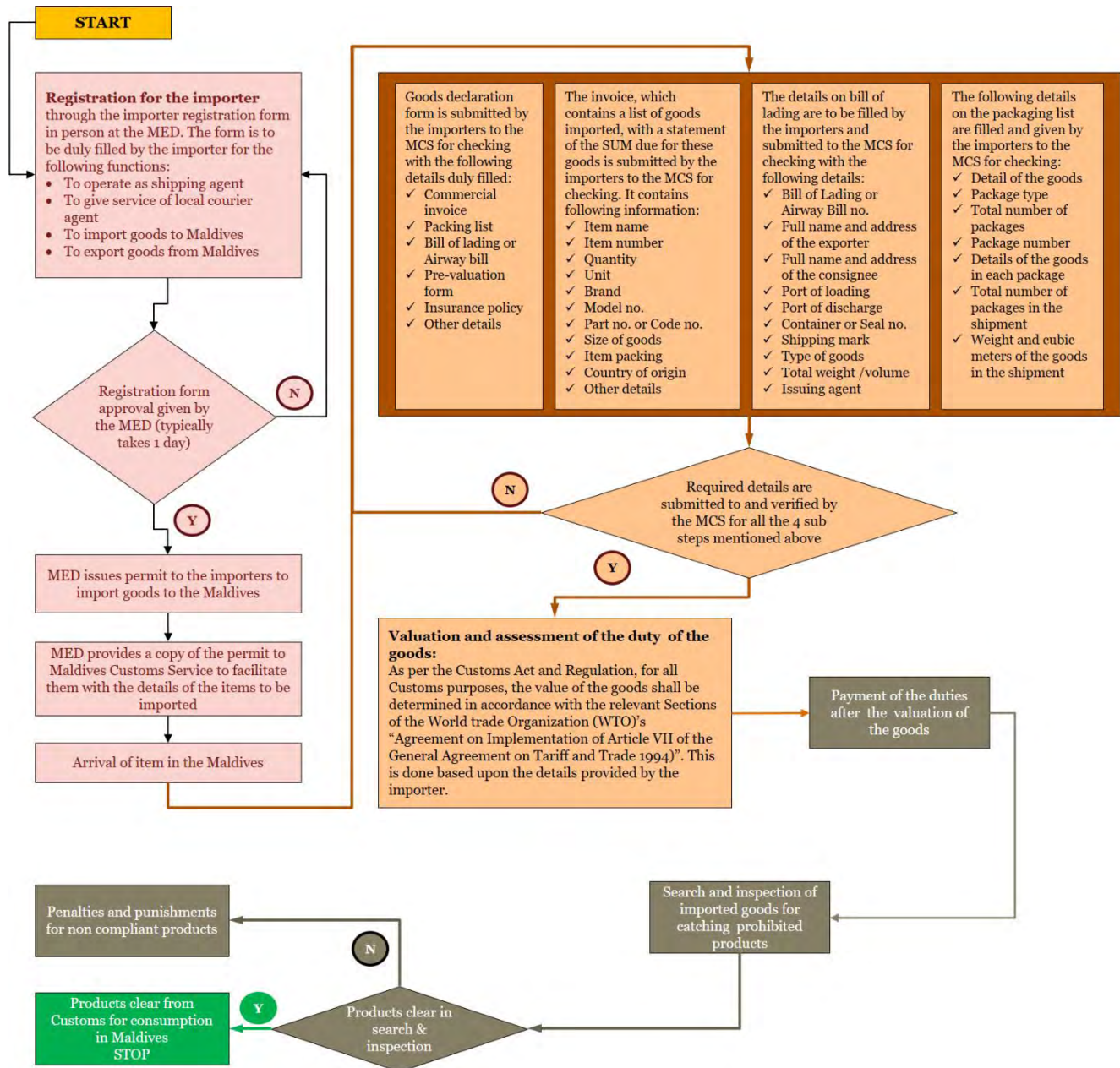
The Customs may carry out an audit of documents related to goods imported and exported to and from the Maldives at a time when transactions with Customs are being processed or even after the completion of the transactions. **The Customs shall inform the exporter or importer of such goods about its decision to carry out such an audit in writing, within a period of 1 (one) year.**

### **E. Search and inspection of the imported goods**

Imported goods to Maldives and goods which are under customs control shall be searched and inspected by customs. Further, customs shall ensure that goods declaration and imported goods tallies and that no import prohibited items are included in the goods imported.

Goods brought under Customs control for contravening law and regulations, seized goods, goods kept under the Customs control, abandoned goods, forfeited goods and other goods confiscated shall be treated as stipulated in the corresponding regulation.

### 3.2. Overall customs clearance process flow

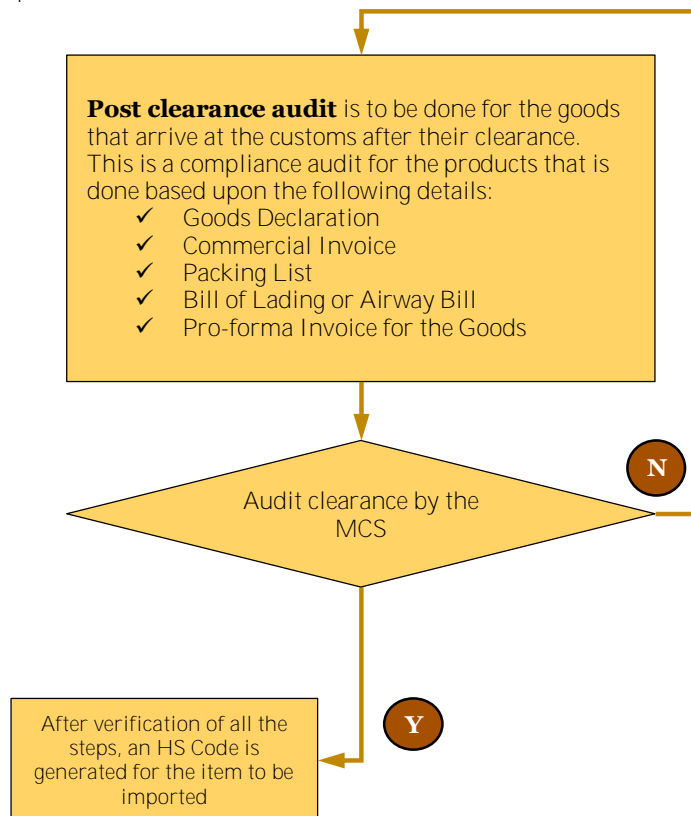


### 3.3. Post clearance customs process flow

The post clearance customs procedure includes the set of processes that are performed after the entry- checking of the product is done. The clearance for these products is already given by the MCS.



The post clearance procedure involves the auditing for the entry-checked products. The post-clearance audit is a compliance-audit that is done based upon the details of a particular product as submitted to the MCS at the time of clearance by the importer, manufacturer or the dealer.



### 3.4. Coordination between the MEA and the MCS

Within the existing procedure of the customs, the import of labelled appliances shall take place as per the steps described in the procedure.

The information about the approved appliances shall be given from the MEA to the MCS. This shall be done for every approved product model, in the form of an online excel sheet that can be updated every day.

Si. No.	Application No.	Applicant Name	Type of appliance	Brand	Model	Information on family of model	Capacity (kg)	Type	Electricity consumption KWh/cycle/kg	Water consumption L/cycle/kg	Cleaning performance	Result
1	A1	Applicant 1	Washing Machine	B1	B1M1	Series M	0.000	Front Load (Drum Type)	0.186	11.31	1.12	Star 1
2	A2	Applicant 2	Washing Machine	B2	B2M1	Series M	0.000	Top Load (Impeller Type)	0.029	14.41	0.95	Disqualified

### 3.5. Coordination between the MCS and the importer

Coordination between the MEA and the importer is required so that the importer submits the information about the product models to be imported, along with the label grade allotted to the product by the MEA.

This information shall be used by the MCS to verify the label grade allotted to the appliance by the MEA and the importer, thereby giving the product a clearance to be imported into the Maldives.

The template of the record shall be same as that of the template in which the MEA conveys the product information to the MCS.

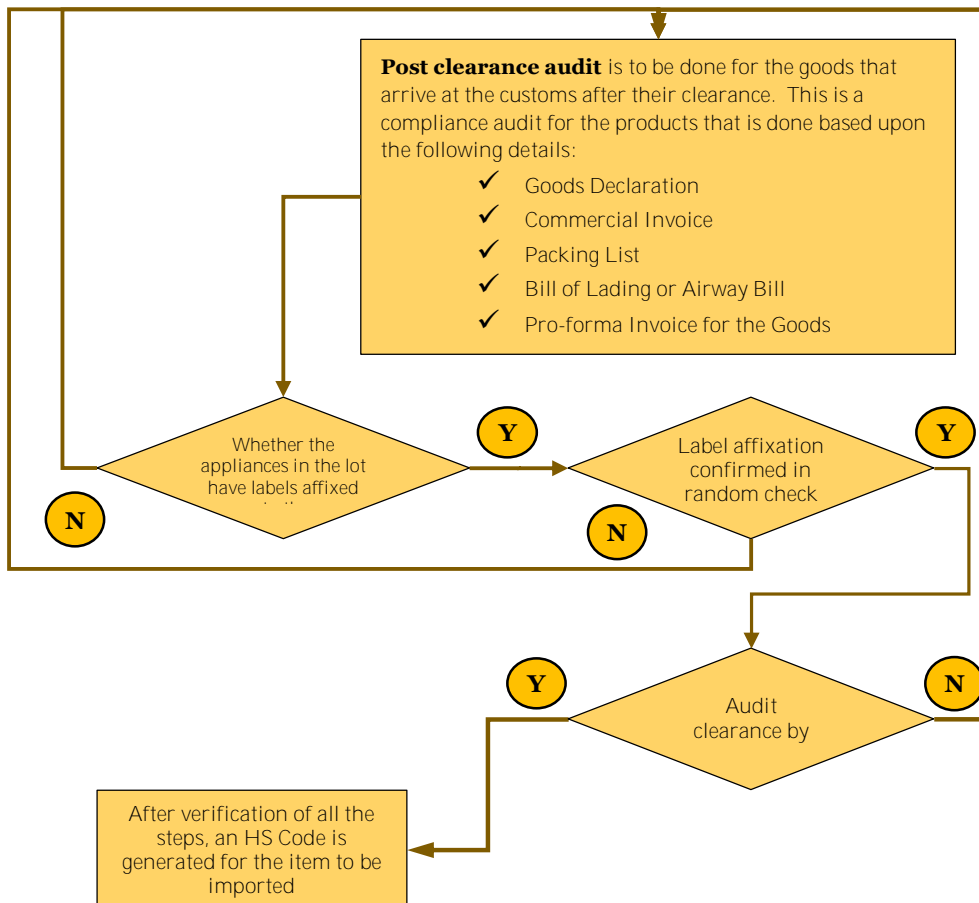
Si. No.	Application No.	Applicant Name	Type of appliance	Brand	Model	Information on family of model	Capacity (kg)	Type	Electricity consumption KWh/cycle/kg	Water consumption L/cycle/kg	Cleaning performance	Result
1	A1	Applicant 1	Washing Machine	B1	B1M1	Series M	0.000	Front Load (Drum Type)	0.186	11.31	1.12	Star 1
2	A2	Applicant 2	Washing Machine	B2	B2M1	Series M	0.000	Top Load (Impeller Type)	0.029	14.41	0.95	Disqualified

### 3.6. MCS to check the import of labelled appliances

To confirm whether the labels are affixed on the products or not, the MCS can add an additional step in the post clearance audit, where the compliance for label affixation can be checked.

As post clearance audit is a compliance audit by nature, the check for label affixation can only be done by checking the details as declared on the products. It can be asked whether the lot under the examination for a particular product has label affixed to them or not.

For confirmation purposes, random checks for a random product lot can be done as well.



## ***4. Process to ensure general safety and block import of counterfeits of labelled appliances***

The general quality of goods that are to be imported into the Maldives can be ensured by standardization of the appliances. The standardization is done as per the safety standards as prescribed by the standards.

To block the counterfeits for a particular appliance, development of an import regulation is done, keeping in mind the customs process that is currently followed.

### ***4.1. Standardization***

For **air conditioners**, the safety standard followed in Malaysia is MS 1597-2-40:2017.

For **refrigerators**, the safety standards followed in Singapore is IEC 60335 - 2-24 ed 7.0 : 2010

For **washing machines**, the safety standards followed in China is GB 4706.24-2008.

In Maldives, there is a requirement to develop safety standards for these appliances that shall be further harmonized with the test standards mentioned above.

The safety standards for a particular appliance vary with the standards that are developed by every country. In general, IEC 60335<sup>8</sup> is the general safety standard for household and similar electric appliances, that is used as a common reference to develop safety standard for a particular appliance by a country.

**Hence, for the purpose of standardization for a particular appliance either of the two options can be followed:**

1. IEC 60335 can be prescribed as the general safety standard as a requirement for import of household appliances. In case the product follows the safety standard of its country of origin then that standard should have been derived from IEC 60335 in order to meet the import requirement.
2. Maldives can also develop its own safety standards for each of the above appliances. The steps to do so are mentioned in the sub section below.

#### ***4.1.1. Steps to standardize the safety standards***

There is specific set of steps followed to standardize the safety standards. This can be explained as follows:

##### **Case Study: To develop and standardize the safety standards for washing machines.**

Following shall be the process flow to develop the safety standards for washing machines.

##### ***Identification of stakeholders***

The stakeholders for a particular appliance are to be identified. The identification of these stakeholders is essential to identify the safety standards that are to be followed at different stages.

**For e.g.** for washing machines, the stakeholders are:

- ✓ MEA
- ✓ MCS
- ✓ AQSIO
- ✓ Importers such as STO, Monalals etc.
- ✓ Dealers and manufacturers

<sup>8</sup> Source: [https://webstore.iec.ch/p-preview/info\\_iec60335-2-40%7Bed4.0%7Den.pdf](https://webstore.iec.ch/p-preview/info_iec60335-2-40%7Bed4.0%7Den.pdf) as retrieved on 7<sup>th</sup> June 2018.

### *Forming a committee*

A committee shall be formed, consisting of all the stakeholders that shall discuss the proposed safety standards.

For every safety standard proposed the stakeholders can either agree to the standard, which shall then be included, or it can be rejected if the stakeholders do not find it to be significant.

**For e.g.** for washing machines, using IEC 60335-2-40, following safety tests are proposed:

- ✓ Protection against access to live parts.
- ✓ Power input and current.
- ✓ Resistance to heat and fire.
- ✓ Leakage current and electric strength at operating temperature.
- ✓ Endurance.
- ✓ Mechanical strength.
- ✓ Construction.
- ✓ Internal wiring.
- ✓ Earthing provisions.
- ✓ Resistance to rusting.
- ✓ Radiation, toxicity and similar hazards.

### *Creating a draft*

After a thorough consultation, the safety standards shall be compiled to form a draft, which shall include:

- ✓ Foreword
- ✓ Introduction
- ✓ Scope
- ✓ Normative references
- ✓ Definitions
- ✓ Tests prescribes
- ✓ Annexes
- ✓ Bibliography
- ✓ Temperature limits

### *Public consultation*

The draft of these safety standards shall be consulted with the public and a feedback from the public shall be taken. If the public safety standards are deemed as satisfactory enough by the public (via the importers), then the safety test standard is adopted as it is. Else, other safety tests that are proposed by the public are added after the consultation with the stakeholders.

### *Finalization of the standards*

After the feedback, the final draft of the safety standards shall be created.

## ***4.2. Development of import regulation***

The purpose of the import regulation shall be as follows:

1. The import regulation shall act as a set of specific rules that shall be followed while importing the products into the Maldives.
2. The import regulation shall help in blocking the import of counterfeits into the Maldives.
3. The import regulation shall create a set of procedures to be followed regarding the penalties and punishments that can be levied over the import of counterfeits.

### ***4.2.1. Import regulation template***

The template of the import regulation can be drafted as follows:

#### **1. Registration under customs**

- ✓ **As discussed in 3.1 A.**

#### **2. Declaration of goods**

- ✓ **As discussed in 3.1 B.**

#### **3. Valuation of goods**

- ✓ **As discussed in 3.1 C.**

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#### 4. Search and inspection of the imported goods

✓ **As discussed in 3.1 E.**

- This shall also include a separate search and inspection for counterfeit, in which the details that have been given by the importer to the MCS are verified by the details about the approved products from the MEA.
- If no counterfeits are detected, the product is cleared, if not, specific penalties and punishments are levied on the importer.
- The penalties and punishments shall be as per the regulations set by the MED.

## 5. Draft energy labelling regulation

This chapter provides the draft energy labelling regulation to be introduced in Maldives for household air conditioners, refrigerators and washing machine.

The regulation contains the scope covered under each appliance, testing guidelines, label qualification requirements and energy efficiency grading criteria.

### 5.1. Energy label regulation – Air Conditioners

This regulation introduces and sets forth requirements for energy efficiency labelling of air conditioners imported and sold in the Maldives. It will be applicable from the day it is published in the Official Gazette.

#### Scope

The scope of the draft regulations on air conditioners in Maldives shall include single-phase single-split and unitary type air conditioners of both fixed speed and variable speed type. The regulation shall to air conditioners sold for household use including the rated capacities of up to 30000 Btu/hr.

#### Definitions

The key terms that are used in the draft regulation have been listed and defined in the table below.

Term	Definition
Act	A statute passed by the parliament of the Maldives
Accredited Laboratory	A laboratory accredited by a recognized accrediting authority to perform testing as per a certain test standard or protocol
Approved test facility	International laboratories recognized by the Ministry of Environment to perform testing
Consumer	An end-user/ purchaser of air conditioners
Customs	Maldives Customs Services (MCS)
Energy Label	Please refer to section 1.8
MEPS	Minimum Energy Performance Standard

#### Normative reference

The documents cited in the draft regulation of air conditioners have been listed below as the normative reference.

- ISO 5151:2010 - Non-ducted air conditioners and heat pumps — Testing and rating for performance
- ISO 16358-1 - Temperature bin distribution shall follow Table 3 of Air-cooled air conditioners — Testing and calculating methods for seasonal performance factors — Part 1
- IEC 62301:2011 - Household electrical appliances - Measurement of standby power

## ***Test guidelines***

The guidelines for the conducting test shall be as per **ISO 5151:2010, ISO 16358-1 and IEC 62301:2011**. The definition and guideline for the conducting measurement of parameters such as CSPF, EER and Standby mode power are mentioned in the points below.

- Cooling Seasonal Performance Factor (CSPF): ratio of total amount of heat the equipment can remove from indoor air when operated for cooling in active mode to the total annual amount of energy consumed by the equipment during the same period. Its unit is Wh/Wh.
- For fixed speed air conditioners,  $CSPF = 1.062 \times EER_{tested}$  at 100% capacity. Energy Efficiency Ratio (EER) is defined as ratio of total cooling capacity to effective power input at any given rating condition. Its unit is kW/kW
- For inverter air conditioners, CSPF is calculated using the measured energy consumption during the tests
- Standby mode: Lowest power consumption mode which cannot be switched off (influenced) by the user and that may persist for an indefinite time when an appliance is connected to the main electricity supply and used in accordance with the manufacturer's instructions
- Standby power: Average power in standby mode when measured in accordance with the specified standard

## ***Test report requirement***

The applicants of the energy label shall get their product tested by an accredited laboratory. The applicant must submit test reports issued by accredited laboratory in the format shown in Appendix B.3. Any deviation from the specified format is not allowed.

## ***Product certification (for safety requirements)***

The safety certification requirements for air conditioners imported into Maldives shall either be according to IEC 60335 or the safety standard followed in the country of origin.

## ***Minimum qualification requirements***

The minimum energy performance of the tested air conditioner in order to be eligible for the energy label are as per the following criteria:

1. Meet the requirements of lowest energy efficiency rating Star (Star 1).
2. Refrigerant's ODP should be Zero.

Both the criteria must be satisfied.

## ***Energy Label***

Energy efficiency labels are informative labels affixed to manufactured products to describe the product's energy performance (usually in the form of energy use, efficiency, or energy cost); these labels give consumers the data necessary to make informed purchases.<sup>9</sup> Maldives will be using comparative labels in the energy efficiency standards and labels program.

## ***Contents of the label***

**The following aspects are included in the EE label for Air Conditioners:**

- Rating
- Value of CSPF (Wh/Wh)
- Test standards used
- Model specific detail
  - Type
  - Brand

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<sup>9</sup> Source: S&L Guide Book, CLASP

- Model number
- Year of manufacture
- Cooling capacity (Btu/h and kW)
- Refrigerant used
- Annual energy consumption (kWh/year)
- Registration number
- Date of issue of label

**Calculation method for Annual Energy consumption**

$$\text{Annual energy consumption} = \frac{\text{CSEC (kWh)}}{1817 \text{ hours}} \times 4380 \text{ hours}$$

Where:

CSEC =Cooling Seasonal Energy Consumption (From Test Report as per ISO 16358)

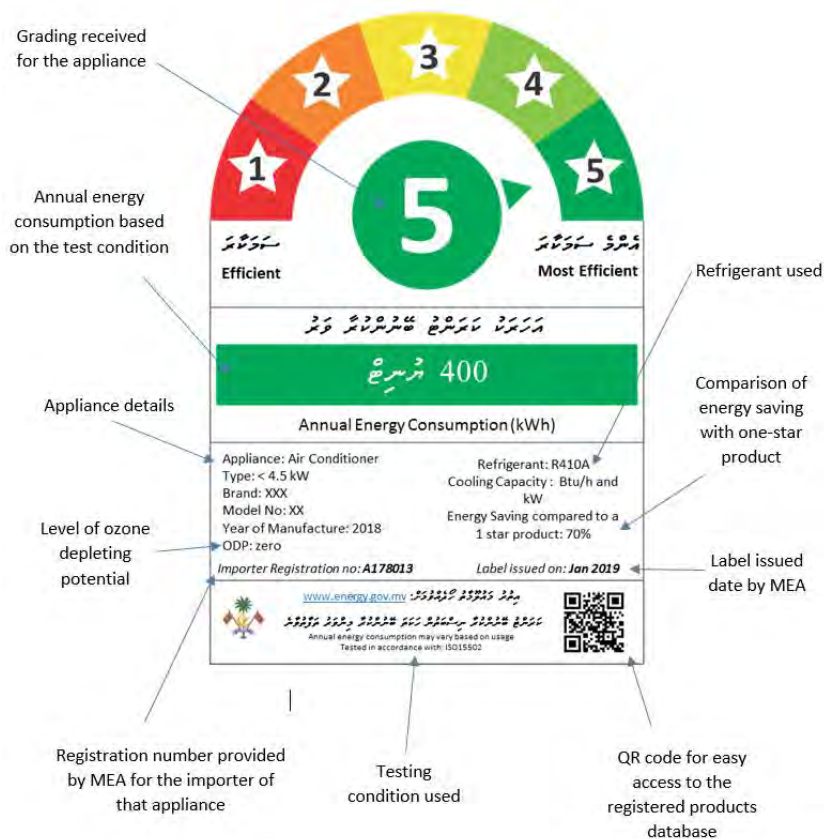
\*Operating hours per year =12 hours per day x 365 day =4380 hours

**Size and dimension of the label**

The size and dimension of the label shall be 13.5 cm length and 9 cm in width.

**Format of the label**

The format of the comparative energy label of air conditioner has been shown below for reference.



**Label variation for different grades.**





## Affixation of the energy label

The label will be placed on the packaging of the appliances before being imported into the country. In addition to this, the label will also be affixed to appliances displayed in the showroom as per MEA's regulation.



## Energy efficiency grading

The energy efficiency grade of an air conditioner model shall be determined on the basis of its Cooling Seasonal Performance Factor (CSPF). It is the ratio of total amount of heat the equipment can remove from indoor air when operated for cooling in active mode to the total annual amount of energy consumed by the equipment during the same period. Its unit is Wh/Wh.

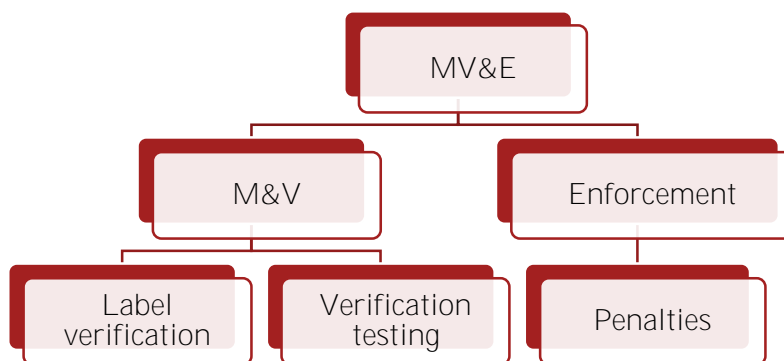
Rating	For ACs with cooling capacities < 4.5 kW	For ACs with cooling capacities between 4.5 kW and 7.1 kW
	Value of CSPF (Wh/Wh)	Value of CSPF (Wh/Wh)
Star 1 (lowest)	< 3.10	< 2.90
Star 2	3.10 – 3.30	2.90 – 3.10
Star 3	3.30 – 4.60	3.10 – 4.00
Star 4	4.60 - 5.30	4.00 - 5.10
Star 5 (highest)	≥5.30	≥5.10

## Implementation Timeframe

The implementation timeframe of activities involved in the standard and labelling of air conditioner in Maldives shall be as per Appendix E.

## Monitoring, verification and enforcement

The MV&E of the standards and labelling programs of air conditioner involves the following components:



### Label Verification

Inspection is conducted to check whether the contents of the label affixed on each appliance match those approved by MEA. Confirming whether the label is affixed properly is also covered.

The inspection officers appointed by MEA will visit the point of inspection and conduct an inspection of the label affixed on the appliances. Comparison of the label with the one approved by MEA is done to assess whether the appliance passes the inspection or not.

### Verification Testing

Verification testing is conducted to check whether the performance of the appliance is as described by the label approved by MEA. This involves sampling of labelled appliances and performing verification testing in independent accredited laboratories. The test results are then evaluated to judge the performance of appliance.

The expected roles and responsibilities of various stakeholders are described below.

Stakeholder	Role	Major responsibilities
<b>Ministry of Environment</b>	Development of the program and revision	<ul style="list-style-type: none"> <li>Develop the standards and labelling program</li> <li>Revise the program accordingly</li> </ul>
<b>Maldives Energy Authority (MEA)</b>	Main implementing organization	<ul style="list-style-type: none"> <li>Responsible for overseeing and executing the market surveillance activities</li> <li>Conduct regular label verification inspections in the marketplace</li> <li>Procure samples from the marketplace for verification testing</li> <li>Coordinate with labelling authorities from other countries for verification testing</li> <li>Maintain list of accredited laboratories for verification testing</li> <li>Coordinate with MCS to ensure that only labelled appliances enter the Maldivian market</li> <li>Oversee smooth implementation of the EE labelling programme</li> </ul>
<b>Maldives Customs Services (MCS)</b>	Regulatory authority over import of labelled appliances	<ul style="list-style-type: none"> <li>Work with MEA to ensure that only labelled appliances enter the Maldivian market</li> <li>Conduct regular inspections of shipments to be imported as per mandate</li> </ul>
<b>Retailers / importers</b>	Target audience of the labelling scheme	<ul style="list-style-type: none"> <li>Support MEA and MCS during the inspection/ market surveillance process</li> </ul>

### ***Prohibition and offences***

The non-compliance and other defaults of the regulation will lead to penalties and punishments, which will be imposed as per the Customs’ law. The criteria for such penalties and punishments will be finalized by MEA after consulting with relevant stakeholders. The same shall be notified by MEA.

The penalty to be submitted by the offender for each non-compliance has been shown below:

	MVR	Paid at
<b>Penalty for non-compliance</b>	5000 per applicant	MEA, MCS

### ***Fee structure***

The fees to be paid by applicant for energy labelling of appliance are divided into two categories.

- Model Registration fee:** It is a non-refundable one-time fee to be submitted for each model by the applicant at the time of registration. The same shall be submitted by the registered applicant for renewal of each model if there is a change in specifications or energy efficiency grade.

2. **Labelling fee:** It is also submitted by the applicant per appliance to make the appliance eligible for labelling.

The fee structure for labelling of air conditioners in Maldives has been shown in the below table.

	<b>Fee Type</b>	<b>MVR</b>	<b>Paid at</b>
<b>Model Registration Fee</b>	One-time fee	500 per model	MEA
<b>Labelling fee</b>	Recurring Fee	15 per appliance	MEA through MCS

## 5.2. Energy label regulation – Refrigerators

This regulation introduces and sets forth requirements for energy efficiency labelling of refrigerator imported and sold in the Maldives. It will be applicable from the day it is published in the Official Gazette.

### Scope

The scope of the draft regulations on refrigerator in Maldives shall include Compression-type Direct-Cool (single-door) refrigerators and Compression-type Frost-Free (double-door, three-door and side-by-side) refrigerators, intended for household use. The regulation shall include refrigerators with rated capacities of 100l-650l.

### Definitions

The key terms that are used in the draft regulation have been listed and defined in the table below.

Term	Definition
Act	A statute passed by the parliament of the Maldives
Accredited Laboratory	A laboratory accredited by a recognized accrediting authority to perform testing as per a certain test standard or protocol
Approved test facility	International laboratories recognized by the Ministry of Environment to perform testing
Consumer	An end-user/ purchaser of refrigerator
Customs	Maldives Customs Services (MCS)
Energy Label	Please refer to section 1.8
MEPS	Minimum Energy Performance Standard

### Normative reference

The documents cited in the draft regulation of refrigerator have been listed below as the normative reference.

- ISO15502 test procedure or IEC 62552 edition 1 - Household refrigerating appliances - Characteristics and test methods - Part 1: General requirements

### Test guidelines

The guidelines for the conducting test shall be as per **ISO 15502 or IEC 62552 edition 1**. The terms and definition as per the test standards are mentioned in the points below.

- **Refrigerating appliance** is a factory-assembled insulated cabinet with one or more compartments and of suitable volume and equipment for household use, cooled by natural convection or a frost-free system whereby the cooling is obtained by one or more energy-consuming means.
- **Refrigerator** is a refrigerating appliance intended for the preservation of food, one of whose compartments is suitable for the storage of fresh food.
- **Compression-type refrigerating appliance** is a refrigerating appliance in which refrigeration is affected by means of a motor-driven compressor.
- **Absorption-type refrigerating appliance** is a refrigerating appliance in which refrigeration is affected by an absorption process using heat as energy source.
- **Refrigerator-freezer** is a refrigerating appliance having at least one compartment suitable for the storage of fresh food (the fresh-food storage compartment) and at least one other (the food freezer compartment) suitable for the freezing of fresh food and the storage of frozen food under three-star storage conditions.

- **Frost-free refrigerator-freezer** is a refrigerator-freezer in which all compartments are automatically defrosted with automatic disposal of the defrosted water and at least one compartment is cooled by a frost-free system.
- **Direct cool refrigerator-freezer** is a refrigerator-freezer in which all compartments are manually defrosted with manual disposal of the defrosted water.
- The **energy consumption test** is the test for the energy consumption by the refrigeration appliance at an ISO tropical temperature of either 16°C or 32°C. **Energy consumption** is calculated as:

$$E_x = E_1 + (E_2 - E_1) \times (t_x - t_1) / (t_2 - t_1)$$

t1 = measured compartment temperature for point 1

t2 = measured compartment temperature for point 2

t<sub>x</sub> = target temperature for the compartment for energy consumption determination

E1 = measured energy consumption of the appliance at point 1

E2 = measured energy consumption of the appliance at point 2

E<sub>x</sub> = calculated energy consumption of the appliance at the target temperature t<sub>x</sub>.

For the given conditions, t<sub>x</sub> = 32°C and E<sub>x</sub> = E<sub>32</sub>.

- **Calculation of V<sub>adj</sub>** – The adjusted volume of a refrigerator shall be calculated through the following formula:

$$V_{adj} = \Sigma(K_c \times \text{Actual volume of the compartment})$$

K<sub>c</sub> is the volume correction factor for a particular type of compartment and is defined as follows:

Compartment Type	Volume Correction Factor (K <sub>c</sub> )
Fresh Food	1.00
4 star freezer	1.79
3 star freezer	1.79
2 star freezer	1.57
1 star freezer	1.36
Chill	1.13
Cellar	0.75

### **Test report requirement**

The applicants of the energy label shall get their product tested by an accredited laboratory. The applicant must submit test reports issued by accredited laboratory in the format shown in Appendix C.3. Any deviation from the specified format is not allowed.

### **Product certification (for safety requirements)**

The safety certification requirements for refrigerator imported into Maldives shall either be according to IEC 60335 or the safety standard followed in the country of origin.

## Minimum qualification requirements

- The minimum coefficient of performance of the tested refrigerator in order to be eligible for the energy label are as mentioned below:

Type	Annual Energy Consumption (AEC) in kwh
	MEPS level
<b>Without freezer</b>	$[(368 + 0.892 \times V_{adj \text{ tot}}) \times 0.551] \geq AEC > [(368 + 0.892 \times V_{adj \text{ tot}}) \times 0.461]$
<b>With freezer (<math>V_{adj \text{ tot}} \leq 300</math> litres)</b>	$[(465 + 1.378 \times V_{adj \text{ tot}}) \times 0.553] \geq AEC > [(465 + 1.378 \times V_{adj \text{ tot}}) \times 0.427]$
<b>With freezer (<math>V_{adj \text{ tot}} &gt; 300</math> and <math>\leq 900</math> litres)</b>	$[(465 + 1.378 \times V_{adj \text{ tot}}) \times 0.506] \geq AEC > [(465 + 1.378 \times V_{adj \text{ tot}}) \times 0.427]$
<b>With freezer, through-the-door ice dispenser</b>	$[(585 + 1.378 \times V_{adj \text{ tot}}) \times 0.485] \geq AEC > [(585 + 1.378 \times V_{adj \text{ tot}}) \times 0.409]$

- The refrigerant's ODP should also be zero in order to be eligible for energy label.

Both criteria should be satisfied.

## Energy Label

Energy efficiency labels are **informative labels affixed to manufactured products to describe the product's energy performance** (usually in the form of energy use, efficiency, or energy cost); these labels give consumers the data necessary to make informed purchases.<sup>10</sup> Maldives will be using comparative labels in the energy efficiency standards and labels program.

## Contents of the label

**The following aspects shall be included in the EE label for Refrigerator:**

- Rating
- Annual Energy Consumption (AEC) in kwh
- Test standards used
- Appliance details
  - Type
  - Brand
  - Model number
- Year of manufacture
- Total Gross Volume
- Total Storage Volume
- Refrigerant used
- Ozone depleting potential
- Registration number
- Date of issue of label

## Size and dimension of the label

The size and dimension of the label shall be 13.5 cm length and 9 cm in width, and may be updated by MEA from time to time.

## Format of the label

The format of the comparative energy label of refrigerator has been shown below for reference.

<sup>10</sup> Source: S&L Guide Book, CLASP



**Label variation for different grades.**



*Affixation of the energy label*

The label will be placed on the packaging of the appliances before being imported into the country. In addition to this, the label will also be affixed to appliances displayed in the showroom as per MEA’s regulation.





## Energy efficiency grading

The energy efficiency grade of a refrigerator model shall be determined on the basis of its Annual Energy Consumption (AEC) in kwh.

Type	Annual Energy Consumption (AEC) in kwh				
	Star 1	Star 2	Star 3	Star 4	Star 5
<b>Without freezer</b>	Not Applicable	$[(368 + 0.892 \times V_{adj\ tot}) \times 0.551] \geq AEC > [(368 + 0.892 \times V_{adj\ tot}) \times 0.461]$	$[(368 + 0.892 \times V_{adj\ tot}) \times 0.461] \geq AEC > [(368 + 0.892 \times V_{adj\ tot}) \times 0.332]$	$[(368 + 0.892 \times V_{adj\ tot}) \times 0.332] \geq AEC > [(368 + 0.892 \times V_{adj\ tot}) \times 0.239]$	$[(368 + 0.892 \times V_{adj\ tot}) \times 0.239] \geq AEC$
<b>With freezer (Vadj tot ≤ 300 litres)</b>	Not Applicable	$[(465 + 1.378 \times V_{adj\ tot}) \times 0.553] \geq AEC > [(465 + 1.378 \times V_{adj\ tot}) \times 0.427]$	$[(465 + 1.378 \times V_{adj\ tot}) \times 0.427] \geq AEC > [(465 + 1.378 \times V_{adj\ tot}) \times 0.312]$	$[(465 + 1.378 \times V_{adj\ tot}) \times 0.312] \geq AEC > [(465 + 1.378 \times V_{adj\ tot}) \times 0.228]$	$[(465 + 1.378 \times V_{adj\ tot}) \times 0.228] \geq AEC$
<b>With freezer (Vadj tot &gt; 300 and ≤ 900 litres)</b>	Not Applicable	$[(465 + 1.378 \times V_{adj\ tot}) \times 0.506] \geq AEC > [(465 + 1.378 \times V_{adj\ tot}) \times 0.427]$	$[(465 + 1.378 \times V_{adj\ tot}) \times 0.427] \geq AEC > [(465 + 1.378 \times V_{adj\ tot}) \times 0.312]$	$[(465 + 1.378 \times V_{adj\ tot}) \times 0.312] \geq AEC > [(465 + 1.378 \times V_{adj\ tot}) \times 0.228]$	$[(465 + 1.378 \times V_{adj\ tot}) \times 0.228] \geq AEC$
<b>With freezer, through-the-</b>	Not Applicable	$[(585 + 1.378 \times V_{adj\ tot}) \times 0.485] \geq AEC > [(585 + 1.378 \times V_{adj\ tot}) \times 0.409]$	$[(585 + 1.378 \times V_{adj\ tot}) \times 0.409] \geq AEC > [(585 + 1.378 \times V_{adj\ tot}) \times 0.298]$	$[(585 + 1.378 \times V_{adj\ tot}) \times 0.298] \geq AEC > [(585 + 1.378 \times V_{adj\ tot}) \times 0.218]$	$[(585 + 1.378 \times V_{adj\ tot}) \times 0.218] \geq AEC$

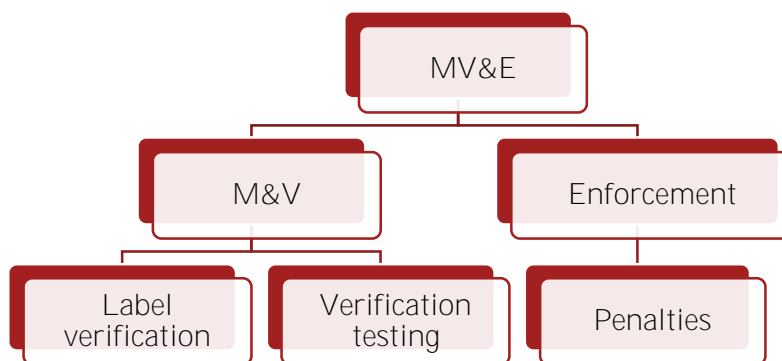
<b>door ice dispenser</b>	$[(585 + 1.378 \times \text{Vadj tot}) \times 0.409]$	$[(585 + 1.378 \times \text{Vadj tot}) \times 0.298]$	$[(585 + 1.378 \times \text{Vadj tot}) \times 0.218]$
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## Implementation Timeframe

The implementation timeframe of activities involved in the standard and labelling of refrigerator in Maldives shall be as per Appendix E.

## Monitoring, verification and enforcement

The MV&E of the standards and labelling programs of refrigerators involves the following components:



### Label Verification

Inspection is conducted to check whether the contents of the label affixed on each appliance match those approved by MEA. Confirming whether the label is affixed properly is also covered.

The inspection officers appointed by MEA will visit the point of inspection and conduct an inspection of the label affixed on the appliances. Comparison of the label with the one approved by MEA is done to assess whether the appliance passes the inspection or not.

### Verification Testing

Verification testing is conducted to check whether the performance of the appliance is as described by the label approved by MEA. This involves sampling of labelled appliances and performing verification testing in independent accredited laboratories. The test results are then evaluated to judge the performance of appliance.

**The expected roles and responsibilities of various stakeholders are described below.**

Stakeholder	Role	Major responsibilities
<b>Ministry of Environment</b>	Development of the program and revision	<ul style="list-style-type: none"> <li>Develop the standards and labelling program</li> <li>Revise the program accordingly</li> </ul>
<b>Maldives Energy Authority (MEA)</b>	Main implementing organization	<ul style="list-style-type: none"> <li>Responsible for overseeing and executing the market surveillance activities</li> <li>Conduct regular label verification inspections in the marketplace</li> </ul>

		<ul style="list-style-type: none"> <li>Procure samples from the marketplace for verification testing</li> <li>Coordinate with labelling authorities from other countries for verification testing</li> <li>Maintain list of accredited laboratories for verification testing</li> <li>Coordinate with MCS to ensure that only labelled appliances enter the Maldivian market</li> <li>Oversee smooth implementation of the EE labelling programme</li> </ul>
<b>Maldives Customs Services (MCS)</b>	Regulatory authority over import of labelled appliances	<ul style="list-style-type: none"> <li>Work with MEA to ensure that only labelled appliances enter the Maldivian market</li> <li>Conduct regular inspections of shipments to be imported as per mandate</li> </ul>
<b>Retailers / importers</b>	Target audience of the labelling scheme	<ul style="list-style-type: none"> <li>Support MEA and MCS during the inspection/ market surveillance process</li> </ul>

## ***Prohibition and offences***

The non-compliance and other defaults of the regulation will lead to penalties and punishments, which will be **imposed as per the Customs' law**. The criteria for such penalties and punishments will be finalized by MEA after consulting with relevant stakeholders. The same shall be notified by MEA.

The penalty to be submitted by the offender for each non-compliance has been shown below:

	<b>MVR</b>	<b>Paid at</b>
<b>Penalty for non-compliance</b>	5000 per applicant	MEA, MCS

## ***Fee structure***

The fees to be paid by applicant for energy labelling of appliance are divided into two categories.

- Model Registration fee:** It is a non-refundable one-time fee to be submitted for each model by the applicant at the time of registration. The same shall be submitted by the registered applicant for renewal of each model if there is a change in specifications or energy efficiency grade.
- Labelling fee:** It is also submitted by the applicant per appliance to make the appliance eligible for labelling.

The fee structure for labelling of refrigerator in Maldives has been shown in the below table.

	<b>Fee Type</b>	<b>MVR</b>	<b>Paid at</b>
<b>Model Registration Fee</b>	One-time fee	500 per model	MEA
<b>Labelling fee</b>	Recurring Fee	15 per appliance	MEA through MCS

## 5.3. Energy label regulation – Washing Machines

This regulation introduces and sets forth requirements for energy efficiency labelling of washing machine imported and sold in the Maldives. It will be applicable from the day it is published in the Official Gazette.

### Scope

The scope of the draft regulations on washing machine in Maldives shall include all residential washing machines, including automatic and semi-automatic, with horizontal axis (front loaders or vertical axis (top loaders) with a capacity of upto 14 kg.

### Definitions

The key terms that are used in the draft regulation have been listed and defined in the table below.

Term	Definition
Act	A statute passed by the parliament of the Maldives
Accredited Laboratory	A laboratory accredited by a recognized accrediting authority to perform testing as per a certain test standard or protocol
Approved test facility	International laboratories recognized by the Ministry of Environment to perform testing
Consumer	An end-user/ purchaser of washing machine
Customs	Maldives Customs Services (MCS)
Energy Label	Please refer to section 1.8
MEPS	Minimum Energy Performance Standard

### Normative reference

The documents cited in the draft regulation of washing machine have been listed below as the normative reference.

- For front loaders: IEC 60456 - Clothes washing machines for household use - Methods for measuring the performance
- For top loaders: JIS 9606 - Electric Washing Machines (foreign standard).

### Test guidelines

All terms and definitions for testing of washing machines are as described in IEC 60456 for front loaders and JIS 9606 for top loaders. The guidelines for the conducting test shall be **as described in IEC 60456 for front loaders, JIS 9606 for top loaders**. The test parameters measured in the testing of washing machines shall be wash performance, rinse performance, spin extraction performance, water consumption per cycle, energy consumption per cycle.

### Test report requirement

The applicants of the energy label shall get their product tested by an accredited laboratory. The applicant must submit test reports issued by accredited laboratory in the format shown in Appendix D.3. Any deviation from the specified format is not allowed.

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## ***Product certification (for safety requirements)***

The safety certification requirements for washing machine imported into Maldives shall either be according to IEC 60335 or the safety standard followed in the country of origin.

## ***Minimum qualification requirements***

The minimum energy performance of the tested washing machine in order to be eligible for the energy label are as per the following criteria:

- Water consumption – 28 L/kg for top loaders, 12 L/kg for front loaders
- Wash performance – 80% for top loaders, 103% for front loaders
- Water extraction efficiency (RMC)<sup>11</sup> ≤ \_\_\_\_% for Top loaders (test as per JIS 9606)
- Water extraction efficiency (RMC)<sup>12</sup> ≤ \_\_\_\_% for Front loaders (test as per IEC 60456)

## ***Energy Label***

Energy efficiency labels are informative labels affixed to manufactured products to describe the product's energy performance (usually in the form of energy use, efficiency, or energy cost); these labels give consumers the data necessary to make informed purchases.<sup>13</sup> Maldives will be using comparative labels in the energy efficiency standards and labels program.

## ***Contents of the label***

**The following aspects shall be included in the EE label for Washing machine:**

- Rating
- Per Cycle Water Consumption (L)
- Per Cycle Electricity Consumption (kWh)
- Test standards used
- Model specific detail
  - Type
- Brand
- Model number
- Year of manufacture
- Capacity (Kg)
- Registration number
- Date of issue of label

## ***Size and dimension of the label***

The size and dimension of the label shall be 13.5 cm length and 9 cm in width.

## ***Format of the label***

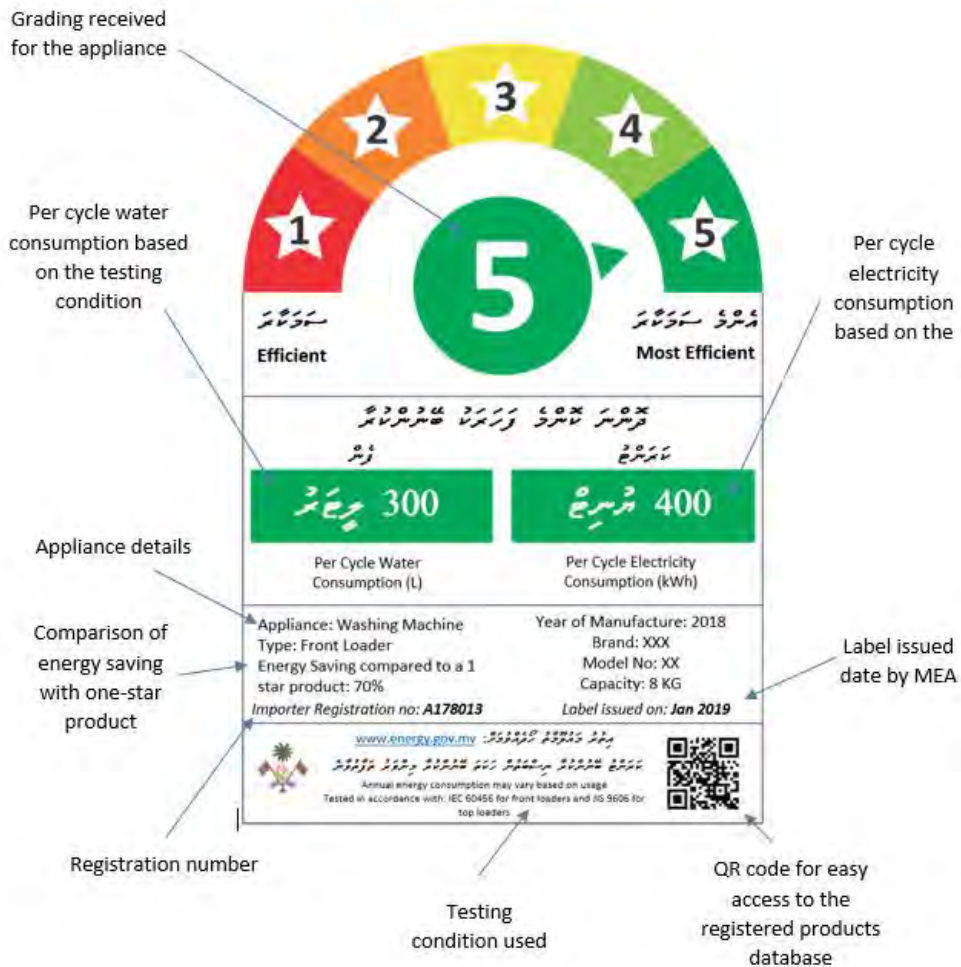
The format of the comparative energy label of washing machine has been shown below for reference.

---

<sup>11</sup> Note for **water extraction efficiency**: The value for water extraction efficiency has been kept blank in the above framework. The value needs to be arrived based on the performance data of washing machines that are being brought in the Maldives. It is suggested that, to begin with MEA shall introduce the programme without minimum requirement for water extraction efficiency. During the programme implementation phase, MEA shall sought the test report for the washing machines which shall have the information on water extraction efficiency. A database shall be developed for water extraction efficiency values and based on this the MEA shall incorporate a prescribed minimum value for water extraction efficiency in consultation with stakeholders.

<sup>12</sup> Same as previous.

<sup>13</sup> Source: S&L Guide Book, CLASP



**Label variation for different grades.**



*Affixation of the energy label*

The label will be placed on the packaging of the appliances before being imported into the country. In addition to this, the label will also be affixed to appliances displayed in the showroom as per MEA’s regulation.



## ***Energy efficiency grading***

The energy efficiency grade of a washing machine model shall be determined based on three parameters:

1. Electricity use kWh per cycle per kg
2. Water consumption (L) per cycle per kg
3. Cleaning performance (min)

The table shown below defines the energy efficiency levels based on the above parameters for both top load and front load washing machines.

EE Level	Top load (impeller type)			Front load (drum type)		
	Electricity use (max) kWh per cycle per kg	Water use (max) L per cycle per kg	Cleaning performance (min)	Electricity use (max) kWh per cycle per kg	Water use (max) L per cycle per kg	Cleaning performance (min)
Star 5 (highest)	0.011	14	0.90	0.11	7	1.03
Star 4	0.012	16	0.80	0.13	8	1.03
Star 3	0.015	20	0.80	0.15	9	1.03
Star 2	0.017	24	0.80	0.17	10	1.03

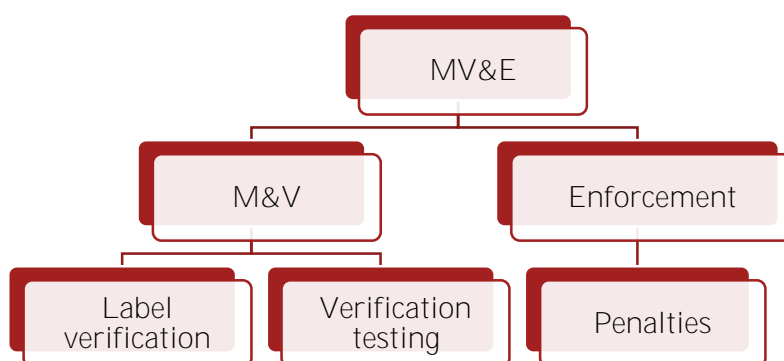
Star 1 (lowest)	0.022	28	0.80	0.19	12	1.03
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## Implementation Timeframe

The implementation timeframe of activities involved in the standard and labelling of washing machine in Maldives shall be as per Appendix E.

## Monitoring, verification and enforcement

The MV&E of the standards and labelling programs of washing machine involves the following components:



### Label Verification

Inspection is conducted to check whether the contents of the label affixed on each appliance match those approved by MEA. Confirming whether the label is affixed properly is also covered.

The inspection officers appointed by MEA will visit the point of inspection and conduct an inspection of the label affixed on the appliances. Comparison of the label with the one approved by MEA is done to assess whether the appliance passes the inspection or not.

### Verification Testing

Verification testing is conducted to check whether the performance of the appliance is as described by the label approved by MEA. This involves sampling of labelled appliances and performing verification testing in independent accredited laboratories. The test results are then evaluated to judge the performance of appliance.

**The expected roles and responsibilities of various stakeholders are described below.**

Stakeholder	Role	Major responsibilities
<b>Ministry of Environment</b>	Development of the program and revision	<ul style="list-style-type: none"> <li>Develop the standards and labelling program</li> <li>Revise the program accordingly</li> </ul>
<b>Maldives Energy Authority (MEA)</b>	Main implementing organization	<ul style="list-style-type: none"> <li>Responsible for overseeing and executing the market surveillance activities</li> <li>Conduct regular label verification inspections in the marketplace</li> <li>Procure samples from the marketplace for verification testing</li> </ul>



		<ul style="list-style-type: none"> <li>Coordinate with labelling authorities from other countries for verification testing</li> <li>Maintain list of accredited laboratories for verification testing</li> <li>Coordinate with MCS to ensure that only labelled appliances enter the Maldivian market</li> <li>Oversee smooth implementation of the EE labelling programme</li> </ul>
<b>Maldives Customs Services (MCS)</b>	Regulatory authority over import of labelled appliances	<ul style="list-style-type: none"> <li>Work with MEA to ensure that only labelled appliances enter the Maldivian market</li> <li>Conduct regular inspections of shipments to be imported as per mandate</li> </ul>
<b>Retailers / importers</b>	Target audience of the labelling scheme	<ul style="list-style-type: none"> <li>Support MEA and MCS during the inspection/ market surveillance process</li> </ul>

## ***Prohibition and offences***

The non-compliance and other defaults of the regulation will lead to penalties and punishments, which will be imposed as per the Customs' law. The criteria for such penalties and punishments will be finalized by MEA after consulting with relevant stakeholders. The same shall be notified by MEA.

The penalty to be submitted by the offender for each non-compliance has been shown below:

	<b>MVR</b>	<b>Paid at</b>
<b>Penalty for non-compliance</b>	5000 per applicant	MEA, MCS

## ***Fee structure***

The fees to be paid by applicant for energy labelling of appliance are divided into two categories.

- Model Registration fee:** It is a non-refundable one-time fee to be submitted for each model by the applicant at the time of registration. The same shall be submitted by the registered applicant for renewal of each model if there is a change in specifications or energy efficiency grade.
- Labelling fee:** It is also submitted by the applicant per appliance to make the appliance eligible for labelling.

The fee structure for labelling of washing machine in Maldives has been shown in the below table.

	<b>Fee Type</b>	<b>MVR</b>	<b>Paid at</b>
<b>Model Registration Fee</b>	One-time fee	500 per model	MEA
<b>Labelling fee</b>	Recurring Fee	15 per appliance	MEA through MCS

# Appendix A. - Sample cover letter to be enclosed by the applicants

*(Sample content of cover letter)*

*(To be prepared in the letterhead of the organization submitting the application (applicant))*

*(Cover letter and complete application needs to be prepared separately for each appliance type i.e. AC, REF, W/M)*

To: **EE Labelling Section**  
**Maldives Energy Authority**  
Ameenee Magu, Maafannu, 20392,  
Male, Republic of Maldives

Date: **[Insert date]**

Subject: Application for seeking approval for EE labelling **[Appliance Type – AC, REF or W/M]**

Dear **[insert recipient name]**,

This is with reference to the above subject and the regulations published by MEA for EE labelling. I, on behalf of the M/s **[insert company name]**, is submitting this application for seeking permission from MEA for EE labelling of following products as per the criterion mentioned in the regulations.

This application is submitted for following product models:

Product	Type	Brand /make	Model No.	Capacity
Air conditioner	Split	B1	M5	_____Btu/hr
Air conditioner	Window	B6	M2	_____Btu/hr

**Enclosures with this application:** (List of forms attached and supporting documents attached)

Kindly evaluate the particulars attached with this application and confirm whether the appliances listed above can be considered for EE labelling as per the regulations rolled out by MEA.

Regards,

**[Insert authorized representative name]**

**[Insert applicant title]**

**[Insert applicant organization name]**

**[Insert applicant address]**

**[Insert applicant suburb/town, state, country and postcode]**

# Appendix B. - Sample forms for Air conditioner

## B.1. Form 1

### Form 1 – Registration of Applicant for Energy Efficiency Labelling Program

#### A. DETAILS OF THE ORGANIZATION

<b>Name of the applicant organization:</b>	
<b>Address:</b>	
<b>Location:</b>	
<b>Postal code:</b>	
<b>Phone number:</b>	
<b>Fax:</b>	
<b>Email:</b>	

#### B. DETAILS OF AUTHORIZED REPRESENTATIVE

<b>Name of the authorized representative:</b>	
<b>Designation:</b>	
<b>Mobile no.:</b>	
<b>Office landline no.:</b>	
<b>Email:</b>	

#### C. APPLIANCES

Which appliance category to be registered (Tick the appliance type – Can tick more than 1)	
Air Conditioner	
Refrigerator	
Washing Machine	

I \_\_\_\_\_ hereby declare that we have read and unequivocally accept the terms and conditions stated in the energy efficiency labelling regulation and shall abide by the same.

Name:

Designation:

Signature:

Stamp

Date:

## ***B.2. Form 2 (Air conditioners)***

### **Form 2 – Registration of Product Model – Air Conditioner**

#### **A. DETAILS OF THE ORGANIZATION:**

<b>Applicant registration number*:</b>	
<b>Name of the authorized representative:</b>	
<b>Designation:</b>	
<b>Mobile no.:</b>	
<b>Office landline no.:</b>	
<b>Email:</b>	

\*Registration number provided by MEA.

#### **B. DETAILS ABOUT THE PRODUCT MODEL**

<b>Sl. No.</b>	<b>Brand</b>	<b>Model No.</b>	<b>Information on Family of Model</b>	<b>Product type*</b>	<b>Name of Refrigerant</b>	<b>Refrigerant's ODP</b>	<b>Refrigerant's GWP</b>

*\*Product Type:*

*Fixed speed unitary type*

*Variable speed unitary type*

*Fixed speed split type*

*Variable speed split type*

#### **C. LABEL DETAILS AS PER THE APPLICANT:**

A sample printed label shall be attached with this application form. The label should capture all details as per the regulation published by MEA.

***Please use the label evaluation tool provided in the Maldives Energy Authority Website.***

## ***B.3. Form 3 (Air conditioners)***

### **Form 3 – Details of Test Results – Air Conditioner**

**The Sections Below Are To Be Filled By the Applicant Based Upon the Test Reports Issued By Accredited Test Laboratories**

#### **A. Details of the test results**

\*Test reports will only be accepted from laboratories accredited by accrediting agencies such as NABL, ILAC and APLAC etc. For a list of accredited laboratories please visit [energy.gov.mv/labelling](http://energy.gov.mv/labelling)

\*For each model stated in Form 2, separate Form 3 should be filled and submitted.

<b>Details of the test laboratory, where the tests as specified by the test standards has been conducted</b>	
<b>Name of the test laboratory:</b>	
<b>Address:</b>	
<b>City:</b>	
<b>Province:</b>	
<b>Postal code:</b>	
<b>Phone number:</b>	
<b>Fax:</b>	
<b>Email:</b>	
<b>Website:</b>	

#### **B. DETAILS OF AUTHORIZED REPRESENTATIVE OF TEST LABORATORY**

<b>Name of the authorized representative:</b>	
<b>Designation:</b>	
<b>Phone no.:</b>	
<b>Email:</b>	

#### **C. INFORMATION ON PRODUCT SAMPLES AND TESTS CONDUCTED**

<b>The following test standards should be followed, and the following tests should be conducted</b>	
<b>1. Test standards followed</b>	ISO 5151:2010 and IEC 62301:2011 test procedure; ISO 16358-1:2013 for test conditions
<b>2. Tests to be conducted</b>	1. Cooling capacity at full load 2. Cooling capacity at half load 3. Input power at full load 4. Input power at half load 5. Standby mode power consumption

<b>Test Report No.</b>	
<b>Date of receipt of sample by the lab</b>	

<b>Date on which the tests are conducted</b>		
<b>Product type (Tick the product type)</b>	Fixed speed	
	Variable speed	
<b>Brand</b>		
<b>Model No.</b>		
<b>Information on Family of Model</b>		
<b>Dimensions</b>		

#### D. SUMMARY OF TEST RESULTS

<b>Brand /make</b>	
<b>Model no.</b>	
<b>Serial no. of the sample tested</b>	
<b>Type (fixed /variable speed)</b>	
<b>Cooling capacity at half load (kW)</b>	
<b>Input power at half load (kW)</b>	
<b>Cooling capacity at full load (kW)</b>	
<b>Input power at full load (kW)</b>	
<b>CSPF value (Wh/Wh)</b>	
<b>CSEC value (kWh) as per ISO 16358</b>	
<b>Year of Manufacturer</b>	

**\*Copy of the original test results should be submitted with this form.**

# Appendix C. - Sample forms for Refrigerator

## C.1. Form 1

### Form 1 – Registration of Applicant for Energy Efficiency Labelling Program

#### A. DETAILS OF THE ORGANIZATION

<b>Name of the applicant organization:</b>	
<b>Address:</b>	
<b>Location:</b>	
<b>Postal code:</b>	
<b>Phone number:</b>	
<b>Fax:</b>	
<b>Email:</b>	

#### B. DETAILS OF AUTHORIZED REPRESENTATIVE

<b>Name of the authorized representative:</b>	
<b>Designation:</b>	
<b>Mobile no.:</b>	
<b>Office landline no.:</b>	
<b>Email:</b>	

#### C. APPLIANCES

<b>Which appliance category to be registered (Tick the appliance type – Can tick more than 1)</b>	
Air Conditioner	
Refrigerator	
Washing Machine	

I \_\_\_\_\_ hereby declare that we have read and unequivocally accept the terms and conditions stated in the energy efficiency labelling regulation and shall abide by the same.

Name:

Designation:

Signature:

Stamp

Date:

## C.2. Form 2 (Refrigerator)

### Form 2 – Registration of Product Model – Refrigerator

#### A. DETAILS OF THE ORGANIZATION:

<b>Applicant registration number*:</b>	
<b>Name of the authorized representative:</b>	
<b>Designation:</b>	
<b>Mobile no.:</b>	
<b>Office landline no.:</b>	
<b>Email:</b>	

\*Registration number provided by MEA.

#### B. DETAILS ABOUT THE PRODUCT MODEL

Sl. No.	Brand	Model No.	Information on Family of Model	Product type*	Name of Refrigerant	Refrigerant's ODP	Refrigerant's GWP

#### **\*Product Type:**

*Refrigerator without freezer*

*Refrigerator with freezer, Adjusted Volume  $\leq 300l$*

*Refrigerator with freezer,  $300l < \text{Adjusted Volume} \leq 900l$*

*Refrigerator with freezer and TTD dispenser*

#### C. Label details as per the applicant:

A sample printed label shall be attached with this application form. The label should capture all details as per the regulation published by MEA.

***Please use the label evaluation tool provided in the Maldives Energy Authority Website.***



## C.3. Form 3 (Refrigerator)

### Form 3 – Details of Test Results – Refrigerator

The Sections Below Are To Be Filled By the Applicant Based Upon the Test Reports Issued By Accredited Test Laboratories

#### A. DETAILS OF THE TEST RESULTS

\*Test reports will only be accepted from laboratories accredited by accrediting agencies such as NABL, ILAC and APLAC etc. For a list of accredited laboratories please visit [energy.gov.mv/labelling](http://energy.gov.mv/labelling)

**\*For each model stated in Form 2, separate Form 3 should be filled and submitted.**

Details of the test laboratory, where the tests as specified by the test standards has been conducted	
Name of the test laboratory:	
Address:	
City:	
Province:	
Postal code:	
Phone number:	
Fax:	
Email:	
Website:	

#### B. DETAILS OF AUTHORIZED REPRESENTATIVE OF TEST LABORATORY

Name of the authorized representative:	
Designation:	
Phone no.:	
Email:	

#### C. INFORMATION ON PRODUCT SAMPLES AND TESTS CONDUCTED

The following test standards should be followed, and the following tests should be conducted	
1. Test standards followed	ISO 15502 test procedure (or IEC 62552 edition 1)
2. Tests to be conducted	1. Energy consumption test 2. Pull down temperature test

Test Report No.		
Date of receipt of sample by the lab		
Date on which the tests are conducted		
Serial no. of the sample tested		
Product type (Tick the product type)	Refrigerator without freezer	
	Refrigerator with freezer, Adjusted Volume ≤ 300l	

	Refrigerator with freezer, 300l < Adjusted Volume ≤ 900l	
	Refrigerator with freezer and TTD dispenser	
<b>Brand</b>		
<b>Model No.</b>		
<b>Information on Family of Model</b>		
<b>Dimensions</b>		
<b>Year of Manufacture</b>		

#### D. SUMMARY OF TEST RESULTS

Energy consumption test result:

Parameters	Specification	Observation	
		Warm	Cold
Average Temperature of freezer compartment (in °C)			
Average temperature of fresh food compartment (in °C)			
Temperature of cellar compartment (in °C)			
Temperature of crisper compartment (in °C)			
Energy meter reading (Wh)			
Time elapsed (minutes)			
Energy consumption rate per day (Wh/day)			
Yearly energy consumption (kWh/year)			

Pull down temperature test result:

Parameters	Specification	Observation after 6 hours in °C (Celsius)
Average temperature of frozen food compartment (in °C)		
Average temperature of frozen food compartment (in °C)		
Temperature of chill compartment (in °C)		
Temperature of cellar compartment (in °C)		

The gross, storage and adjusted volume test result:

Gross volume (in L)		
Freezer compartment	Fresh food compartment	Total

--	--	--

Storage volume (in L)		
Freezer compartment	Fresh food compartment	Total

Compartment Type	Volume Correction Factor (K <sub>c</sub> )	Compartment-wise volume (L)
<b>Fresh Food</b>	1.00	
<b>4 star freezer</b>	1.79	
<b>3 star freezer</b>	1.79	
<b>2 star freezer</b>	1.57	
<b>1 star freezer</b>	1.36	
<b>Chill</b>	1.13	
<b>Cellar</b>	0.75	

Total adjusted storage volume:

<b>Total adjusted storage volume (in L)</b>	
---	--

**\*Copy of the original test results should be submitted with this form**

# Appendix D. - Sample forms for Refrigerator

## D.1. Form 1

### Form 1 – Registration of Applicant for Energy Efficiency Labelling Program

#### A. DETAILS OF THE ORGANIZATION

<b>Name of the applicant organization:</b>	
<b>Address:</b>	
<b>Location:</b>	
<b>Postal code:</b>	
<b>Phone number:</b>	
<b>Fax:</b>	
<b>Email:</b>	

#### B. DETAILS OF AUTHORIZED REPRESENTATIVE

<b>Name of the authorized representative:</b>	
<b>Designation:</b>	
<b>Mobile no.:</b>	
<b>Office landline no.:</b>	
<b>Email:</b>	

#### C. APPLIANCES

<b>Which appliance category to be registered (Tick the appliance type – Can tick more than 1)</b>	
Air Conditioner	
Refrigerator	
Washing Machine	

I \_\_\_\_\_ hereby declare that we have read and unequivocally accept the terms and conditions stated in the energy efficiency labelling regulation and shall abide by the same.

Name:

Designation:

Signature:

Stamp

Date:

## ***D.2. Form 2 (Washing Machine)***

### **Form 2 –Registration of Product Model –Washing Machine**

#### **A. DETAILS OF THE ORGANIZATION:**

<b>Applicant registration number*:</b>	
<b>Name of the authorized representative:</b>	
<b>Designation:</b>	
<b>Mobile no.:</b>	
<b>Office landline no.:</b>	
<b>Email:</b>	

\*Registration number provided by MEA.

#### **B. DETAILS ABOUT THE PRODUCT MODEL**

<b>Sl. No.</b>	<b>Brand</b>	<b>Model No.</b>	<b>Information on Family of Model</b>	<b>Product type</b>

*\*Product Type:*

*Top load (impeller type)*

*Front load (drum type)*

#### **C. LABEL DETAILS AS PER THE APPLICANT:**

A sample printed label shall be attached with this application form. The label should capture all details as per the regulation published by MEA.

***Please use the label evaluation tool provided in the Maldives Energy Authority Website.***

## D.3. Form 3 (Washing Machine)

### Form 3 – Details of Test Results – Washing Machine

The Sections Below Are To Be Filled By the Applicant Based Upon the Test Reports Issued By Accredited Test Laboratories

#### A. DETAILS OF THE TEST RESULTS

\*Test reports will only be accepted from laboratories accredited by accrediting agencies such as NABL, ILAC and APLAC etc. For a list of accredited laboratories please visit [energy.gov.mv/labelling](http://energy.gov.mv/labelling)

**\*For each model stated in Form 2, separate Form 3 should be filled and submitted.**

Details of the test laboratory, where the tests as specified by the test standards has been conducted	
Name of the test laboratory:	
Address:	
City:	
Province:	
Postal code:	
Phone number:	
Fax:	
Email:	
Website:	

#### B. DETAILS OF AUTHORIZED REPRESENTATIVE OF TEST LABORATORY

Name of the authorized representative:	
Designation:	
Phone no.:	
Email:	

#### C. INFORMATION ON PRODUCT SAMPLES AND TESTS CONDUCTED

The following test standards should be followed, and the following tests should be conducted	
1. Test standards followed	1. IEC 60456 test procedure (for front loaders) 2. JIS 9606 test procedure (for top loaders & semi-automatic)
2. Tests to be conducted	1. Wash performance (soil removal) 2. Rinse efficiency 3. Energy consumption 4. Water consumption 5. Water extraction

Test Report No.	
-----------------	--

<b>Date of receipt of sample by the lab</b>		
<b>Date on which the tests are conducted</b>		
<b>Product type (Tick the product type)</b>	Semi-automatic machine	
	Front loader	
	Top loader fully automatic	
	Washer dryer	
<b>Brand</b>		
<b>Model No.</b>		
<b>Information on Family of Model</b>		
<b>Dimensions</b>		

#### D. SUMMARY OF TEST RESULTS

<b>Brand /make</b>	
<b>Model no.</b>	
<b>Washing machine type</b>	
<b>Serial no. of sample tested</b>	
<b>Capacity (kg)</b>	
<b>In-built heater present (yes/no)</b>	
<b>Wash /Rinse program followed</b>	
<b>Electricity consumption (kWh/kg/cycle)</b>	
<b>Water consumption (L/kg/cycle)</b>	
<b>Wash performance (%)</b>	
<b>Rinse performance</b>	
<b>Remaining moisture content (RMC) %</b>	
<b>Year of Manufacturer</b>	

**\*Copy of the original test results should be submitted with this form**

# Appendix E. - Implementation timeframe

S. No.	S&L major steps and sub activities	2020											
		M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	
		1	<b>Institutional infrastructure and capacity building</b>										
a	Building adequate capacity within MEA for implementation of all elements within the S&L program												
b	Training and exposure to international practice for implementation (covering minute details of each element within the program)												
c	Capacity building cum training program for importers, sales person, customs, local government agencies and other stakeholders												
2	<b>Launch of S&amp;L program for appliances</b>												
a	Announcement for launch of efficiency standards and labelling regulation for air conditioners, refrigerators and washing machines in voluntary phase and defining the timeline for launch of mandatory regime												
b	Designing of communication campaign and outreach plan												
c	Launch awareness communications program												
3	<b>Monitoring, verification and enforcement protocols</b>												
a	Assess the implementation of monitoring and verification and enforcement guidelines												
b	Implement label inspection measures												
c	Conduct verification testing protocol to evaluate compliance of energy consumption with respect to labelling criteria												
4	<b>Impact assessment</b>												
a	Conduct impact assessment (half yearly and yearly)												



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**Ministry of Environment**

# Development and Implementation of Standards and Labelling Programme in the Maldives

*Framework to Monitor Implementation of EE  
Labelling Programme – Task 4*

Strengthening Low Carbon  
Energy Island Strategies (LCEI) Project



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## List of abbreviations

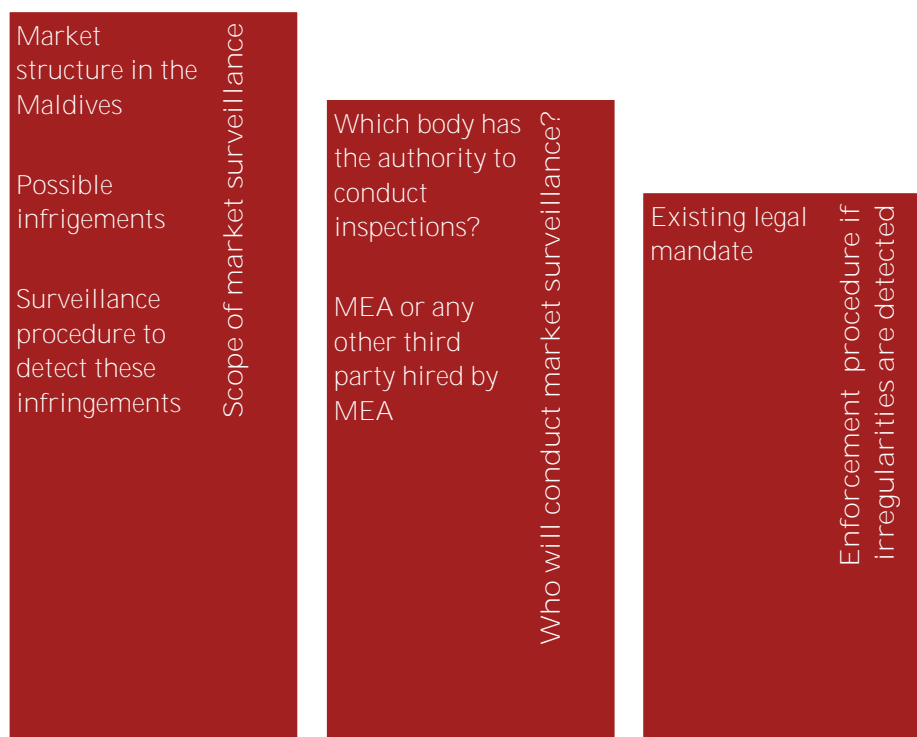
EE	Energy Efficiency
M&V	Monitoring and verification
MEA	Maldives Energy Authority
MCS	Maldives Customs Services
MED	Ministry of Economic Development
TTD	Through The Door Dispenser
ME	Ministry of Environment
FOB	Free On Board

# 1. Introduction

The task “Framework to Monitor Implementation of the EE Labelling Programme” deals with developing a monitoring framework for the labelling scheme in the Maldives.

A robust monitoring and verification framework is imperative to ensure the sanctity and effective adoption of the energy efficiency labelling programme. A robust M&V framework ensures that stakeholders are adhering to the provisions of the scheme and the performance of the appliances is correctly described by their label. This is important to maintain consumer confidence and the sanctity of the labelling scheme, and is imperative to achieve its potential savings.

A monitoring framework as per the local requirements for a labelling programme shall have three major components – (i) Defined scope of market surveillance; (ii) Authority responsible to conduct market surveillance identified; and (iii) Procedures to be followed if irregularities are detected are defined.



*Figure 1: Components of a monitoring framework*

The activities involved under market surveillance for the labelling programme would depend on the requirements that the programme sets on retailers and appliances, the existing market structure in the Maldives and the proposed implementation procedure.

An outline of the existing import process for appliances is shown in the figure next. At the holistic level, an appliance to be imported into the Maldives goes through the following steps before reaching the consumer **through an importer’s retail outlet, once the labelling scheme for appliances is established:**

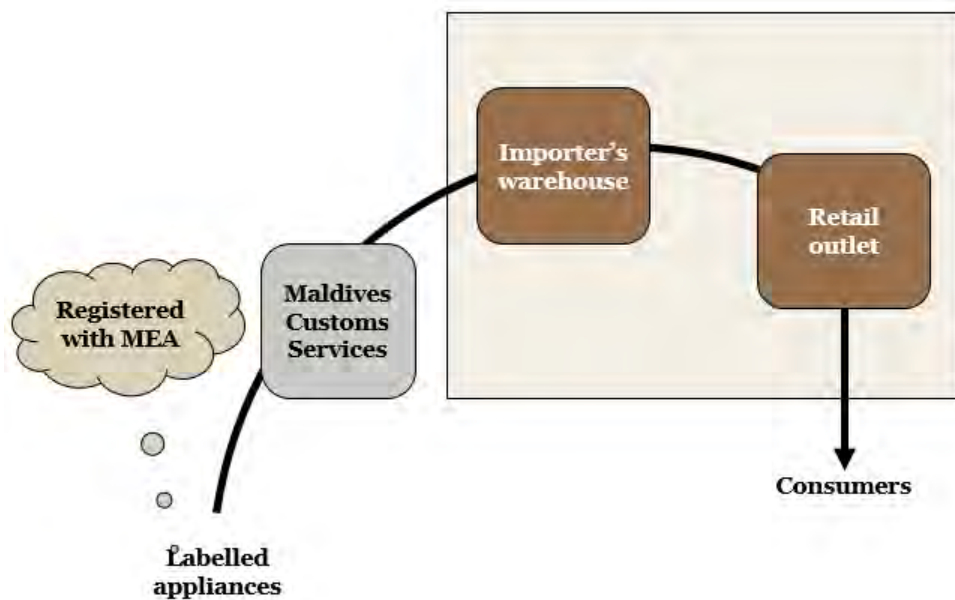
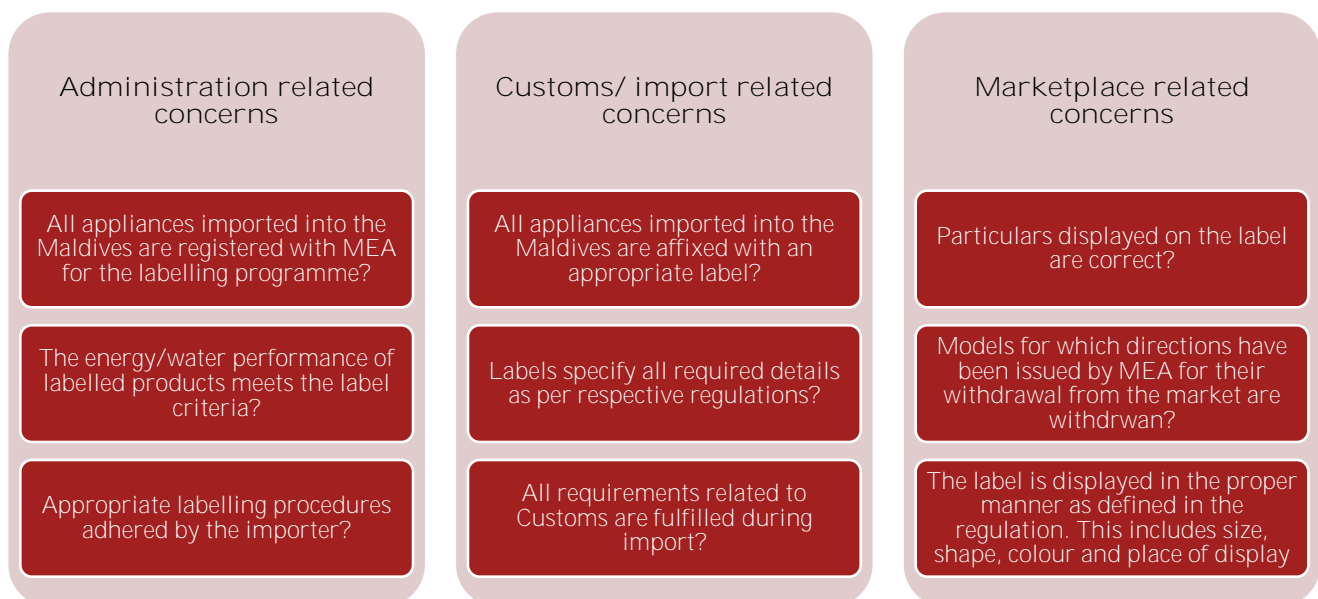


Figure 2: Overview of the existing import process

- Registration of appliance product model with Maldives Energy Authority for the aspects pertaining to the labelling programme, such as approval of label details, submission of test reports etc.
- **Appliances are imported into the Maldives as per Maldives Customs Services' (MCS) procedure.** This includes registration of importer with MED, submission of invoice, post clearance audit procedure etc.
- **Once cleared by Customs, the appliances are transferred to the importer's warehouse, and then to the retail outlets at the importer's or retailer's discretion.**
- Consumers purchase the appliances from the retail outlets.

Within the overall implementation process, some of the key aspects to be monitored can be segmented into following categories:



Enforcement actions are taken on user of label /importers if an appliance fails to comply with any of the above requirements.

---

## *1.1. Key components of monitoring framework /market surveillance*

Broadly, the monitoring framework can be segregated into independent components such that each of these activities is carried out effectively and efficiently. These components are:

- Label inspection,
- Verification testing,
- Enforcement

### *Label inspection*

Label inspection (surveillance of energy efficiency label in market place) is conducted to check whether the contents of the label affixed on each appliance match those approved by MEA. Confirming whether the label is affixed properly, i.e. in the correct position, correct size, correct colour, etc., is also covered under label inspection.

To conduct label inspection, a comprehensive inspection process is required. The inspection officers would have to visit the marketplace (or any other point of inspection) and conduct an inspection of the label affixed on the appliances. Comparison of the label with the one approved by MEA will be adequate to judge whether the appliance passes label inspection.

### *Verification testing*

Complementing the label verification, verification testing is conducted to check whether the performance of the appliance is as described by the label approved by MEA. This involves sampling of labelled appliances and performing verification testing in independent accredited laboratories. The test results are then evaluated to judge the performance of appliance.

### *Enforcement*

Enforcement refers to creating a mechanism for adherence to the regulations introduced by MEA. It covers the actions taken by MEA or other competent authorities if an appliance fails to comply with requirements of the EE Labelling scheme.

A more detailed reference of Monitoring, Verification and Evaluation (MVE) practices in key S&L programmes across relevant countries is provided as Appendix E with this framework.

## 2. Process and procedure for market surveillance

The chapter provides a detailed process for market surveillance. The objective is to build the capacity of stakeholders in the country to undertake the surveillance of energy efficiency policy measures. The chapter has been structured in followed broad sections:

- Label inspection process
- Verification testing process
- Enforcement

### 2.1. Label inspection process

#### 2.1.1. Key aspects of label inspection

First of all, it is important to define key aspects of inspection process, as proposed below:

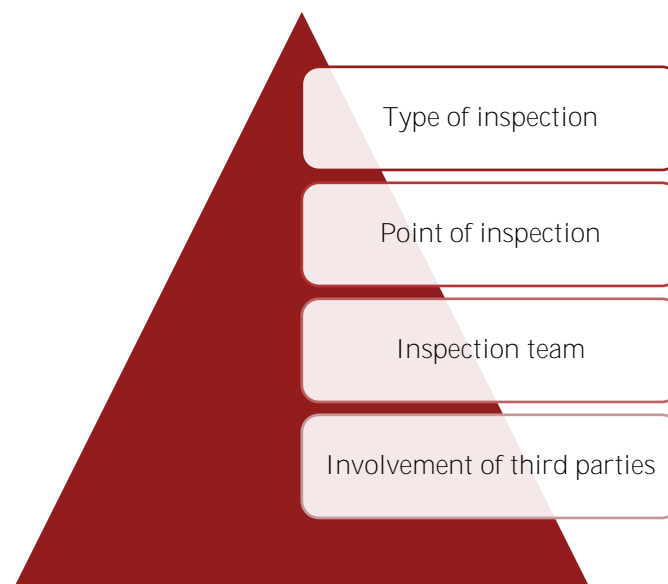


Figure 3: Key aspects of label inspection under market surveillance process

#### Types of inspections for conducting energy efficiency label

In general, two types of inspections are proposed based on the scope—targeted inspection and general inspection.

- Targeted inspections are conducted to verify the compliance of a particular product model or a particular manufacturer with the provisions of the labelling programme. These are conducted for specific reasons such as verifying non-compliance of a particular model, non-availability at directions of MEA, etc.



- General inspections are not tied to one type of product or model. It consists of general surveillance activities in the marketplace or warehouses.



Figure 4: Types of inspections

### Point of inspection

The point of inspection refers to that point in the supply chain where the inspection is being conducted. The points could be retail stores, warehouses, distribution centers and places of import. An overview of scenarios in each of the case is illustrated in the following figure.

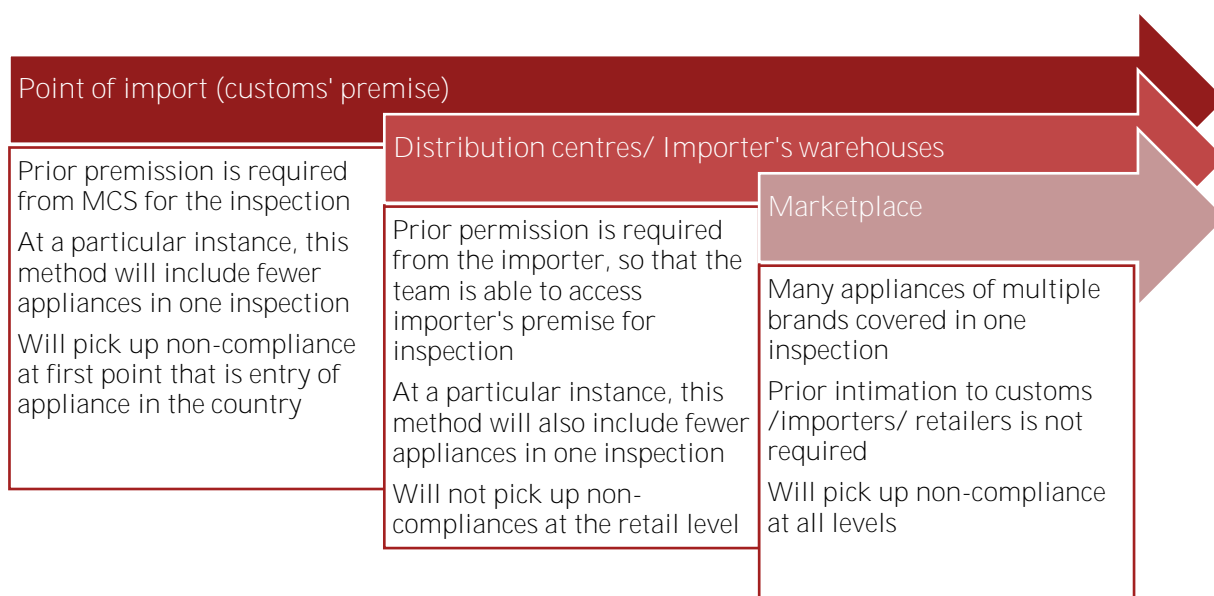


Figure 5: Points of inspection

### Team

The market surveillance work under the proposed S&L programme requires a team with clear roles and responsibilities. Unless a proper team of resource is formed it is difficult to maintain integrity within the overall process. The team shall be structured with following key responsibilities properly defined:

- Monitoring and verification in-charge responsible for overlooking the complete process. The position shall provide an authority for approving the inspection plan and allowing the conduct of inspection; conduct of verification testing and complete operations under the market surveillance requirements.
- A team of officers responsible for developing the plan for market surveillance; arranging the necessary clearances; conduct of on-ground inspection as per the requirement of programme; channelize the verification testing; summarise and analyse the results of market surveillance; etc.

The inspection team should be formed such that inspections are carried out quickly and integrity is maintained. As an example, the procedure followed by other government departments such as Customs can be adopted for this purpose.

### *Involvement of third parties*

Involvement of third parties in the inspection process is an important factor from an administrative, authenticity and practical point of view. The third parties could be organizations hired by MEA for the purpose of conducting market surveillance as per the directions of MEA; or third parties could be other departments under ME, other ministries, etc. The third party including its staff needs to act as an independent agency such that it should not develop any conflict with the objective of surveillance. To begin with, officers from other departments etc. can support MEA officials in conducting the inspection.

### *2.1.2. Label inspection process flow*

Broadly, the label inspection process shall encompass following sub-steps.



*Figure 6: Label inspection process flow*

### *Inspection plan*

Preparation of inspection plan is the starting step. It is the method to record and keep track of inspections to be conducted. The inspection plan shall be prepared by the relevant department / team assigned by MEA. In general, the inspection plan shall include the following information:

- Inspection type: General inspection/ targeted inspection
- **Point of inspection: Marketplace, warehouse or importer’s premise, custom’s location**

- Inspection location: Geographical location including the specific addresses
- Inspection team: Names of individuals and their organization (involvement of third parties such as witnesses, etc.)
- Day, date and time of inspection
- Specific targets
- Dispatch of notice to relevant authorities for seeking permission (if required)
- Budget

Once the plan has been developed by the inspection team, it shall be sent for approval of competent authority.

### *Conduct of inspection*

The actual conduct of on-ground inspection needs to be performed with an aim to assess the conformance of energy efficiency labels. The team of inspection officers shall have the capacity to understand possible non-conformances that might be available and shall also have adequate understanding of the S&L programme. An illustrative list of probable non-conformities in energy efficiency label is listed below:

*Table 1: Possible non-compliance situations in label inspection*

Sr. No.	Possible non-compliance situation
1.	A model of an appliance for which labelling is mandatory does not display the label
2.	A model of an appliance for which labelling is voluntary, has registered with MEA, but does not display a label
3.	The label displayed on a model is not displayed as required by the respective regulation <i>This includes cases where the model is not in compliance with the requirements of the regulation</i>
4.	The label displayed on a model of an appliance is not directly visible ( <i>i.e. consumers may not be able to see it while purchasing the model</i> ) <i>This includes cases where the model is in compliance with the requirements of the regulation, but the label is not visible at the store.</i>
5.	A model of an appliance displays a label, but is not registered in the MEA database.
6.	The label displayed on a model of an appliance has surpassed its validity period
7.	The particulars displayed on the label on a model are not as approved by MEA ( <i>i.e. cases of intentional fraud</i> )
8.	A model <b>that has been marked as “STOP SALE” is still being sold at the store</b>

The team of inspection officers shall arrange for items required and prepares for the inspection.

#### Inspection at marketplace

Once the inspection team arrives at the marketplace, they shall decide or refer inspection plan for which retail store to be visited to conduct inspections.

- At first, the team shall identify and visit few stores in the marketplace where a majority of the appliances under the labelling programme can be covered.

- The inspecting officers upon entering the retail store shall brief the store manager on the inspection and seek his cooperation. The officers shall then inspect the EE label affixed on **appliances kept on the store's** display as per the inspection procedure.
- The inspection officers shall compare the EE label affixed on the appliances with the details approved by MEA for that particular product model. The results of inspection shall be recorded in the prescribed templates.
- Once the appliances at the store have been checked, the inspection officers shall acquire the signature of the retail store manager and exit the store.

#### Inspection at warehouse or at MCS

The inspection procedure at the warehouse is similar to the procedure at the marketplace. However, prior permission may be required to enter the place for inspection.

- The inspecting officers upon entering the premise shall ask the concerned authority to give them a list of all appliances stored at the premises (including model numbers). This will provide the inspection officers with an estimate of time needed to conduct the inspection and a reference point.

*Table 2: Physical vs. computer aided market surveillance*

#### *Physical vs Computer Assisted market surveillance*

- As described above, the market surveillance process is quite data extensive and required handy access to the S&L database maintained by the MEA. In the first few months/ years of the labelling programme, where the size of the database is not very large, this can be managed through physical inspections, using templates and printouts.
- However, the most efficient way for conducting market surveillance is using computer-assisted surveillance techniques. It is envisaged that MEA can keep special mobiles /tablets to be used only for inspection purposes. An android /IOS application made for inspection purposes shall be loaded onto these devices to be used at the time of inspection.
- **This app can be synchronized with MEA's database and have the functionality to check whether a label attached to an appliance is authentic.** The app will also have the functionality to capture proofs and generate inspection reports for each inspection

#### *Preparation of inspection report*

Post inspection, the inspection team shall generate the inspection report. A consolidated report of the inspection and its findings and recommended actions is prepared and submitted to the Inspection in-charge. The inspection team shall be responsible for the preparation and submission of report. The Inspection in-charge shall submit the report to the competent authority under MEA for review and actions as required.

#### *Analysis of findings during market surveillance*

MEA shall have a complete report of inspections conducted over the year. Using this database, MEA shall analyse the findings and identify those appliances which have frequently failed in label inspection conducted across the country.

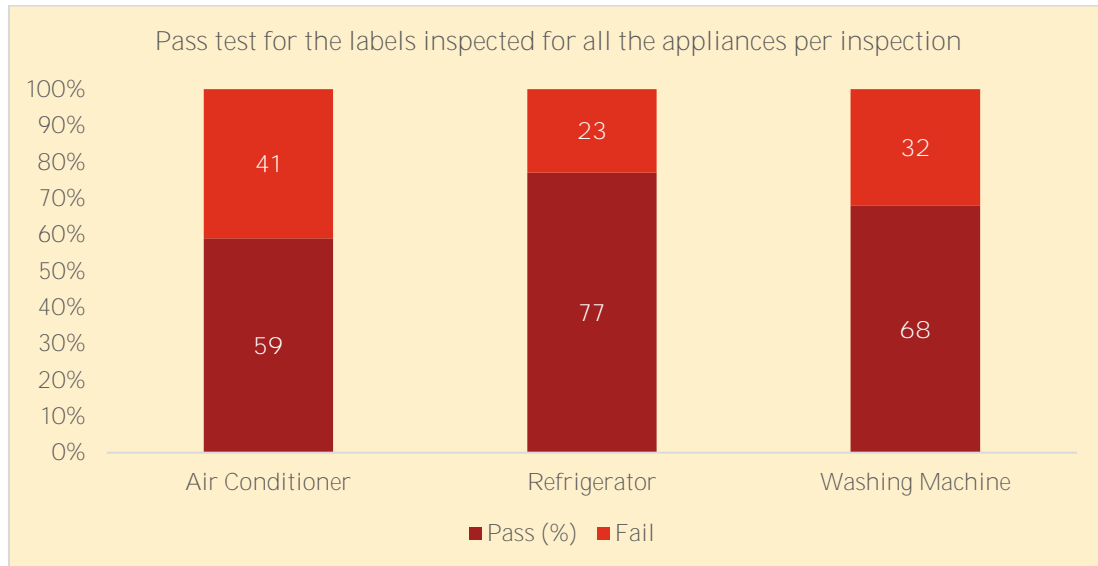
The findings by the inspections can be analysed through graphical mediums. There can be an analysis on an annual scale and/ or an analysis on a periodic basis.

## Illustrative visuals for analysis

Following are the illustrative visuals that can be used to aid the analysis:

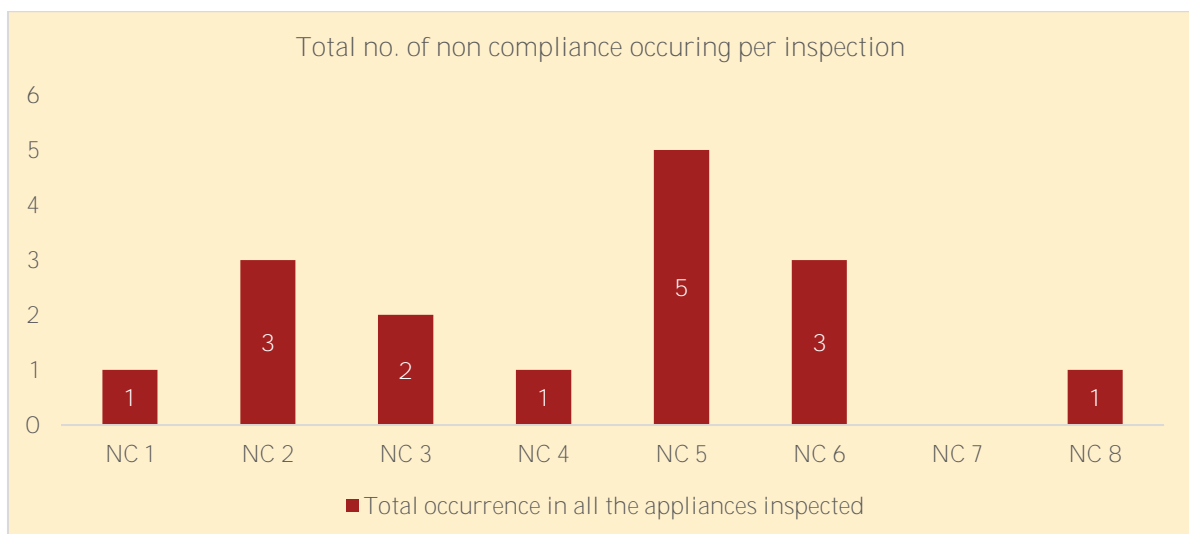
### 1. Analysis of all the appliances inspected per inspection

- This graphical representation of this analysis is done assuming that the label inspection for all 3 appliances is done for a particular inspection.
- The values represented by the analysis are hypothetical, assumed only to pictorially represent the analysis.



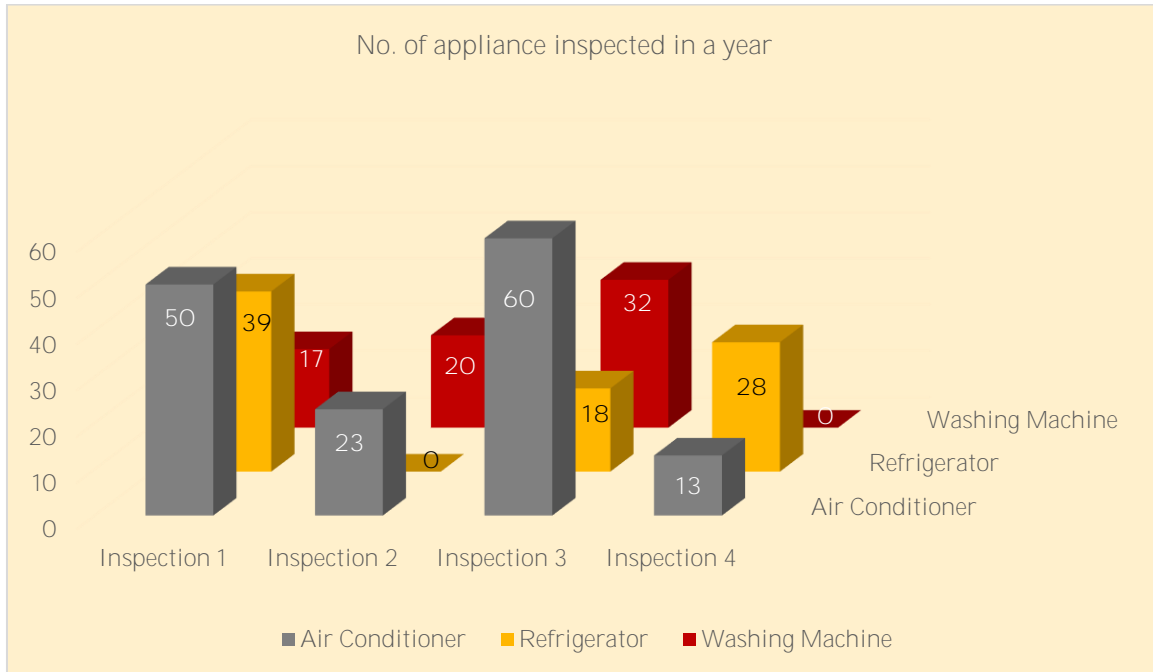
### 2. Type of non-compliance occurring per inspection

- This graphical representation of this analysis is done assuming that the non-compliance has been checked in all the appliances covered per inspection.
- The values represented by the analysis are hypothetical, assumed only to pictorially represent the analysis.



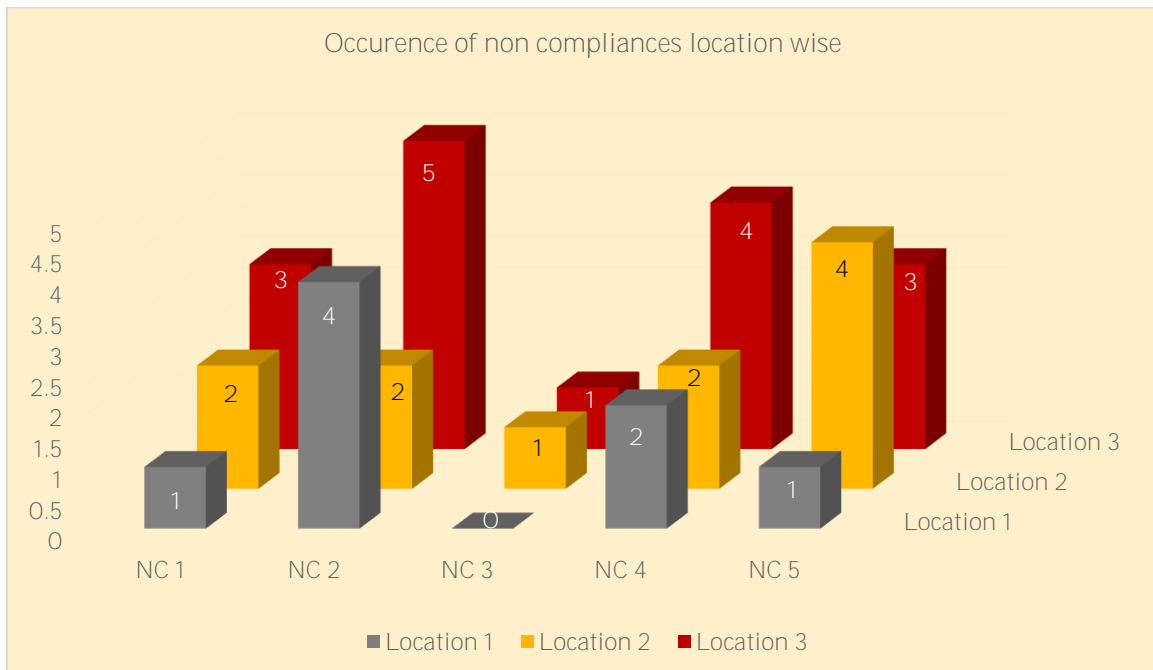
### 3. Appliances covered per inspection

- This graphical representation of this analysis is done assuming that a certain no. of appliances have been covered in several inspections done in a certain period of time (annual in this case)
- The values represented by the analysis are hypothetical, assumed only to pictorially represent the analysis.



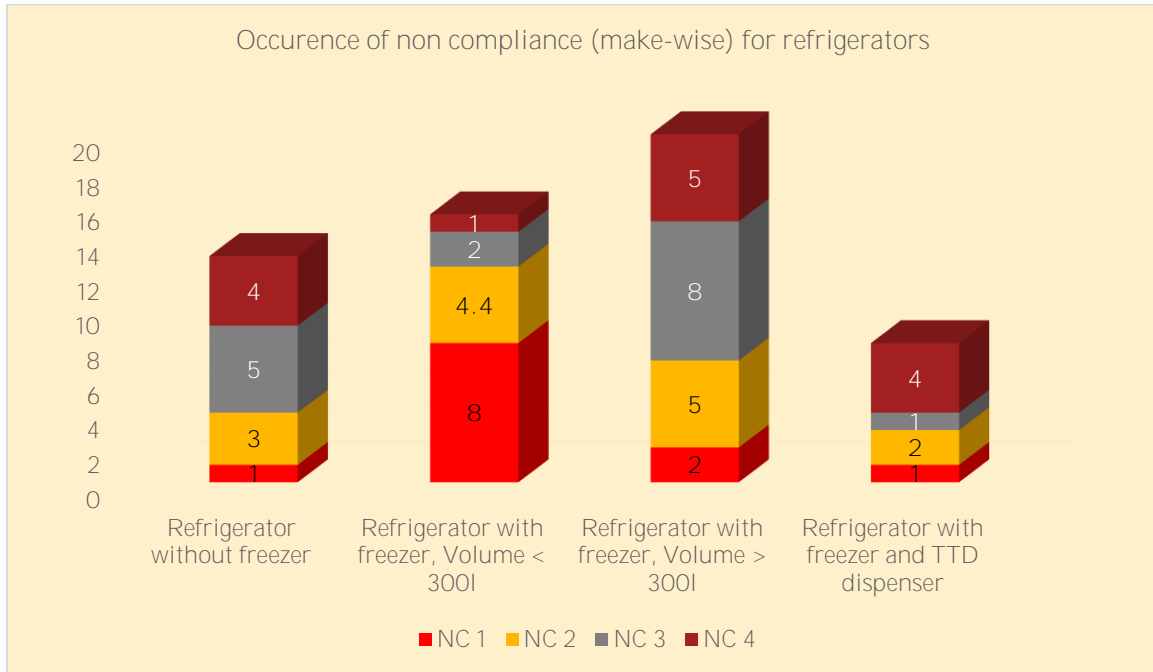
#### 4. Location wise analysis of non-compliance

- This graphical representation of this analysis is done assuming that a certain no. of non-compliances have been observed in inspections done in a certain period of time at certain locations
- The values represented by the analysis are hypothetical, assumed only to pictorially represent the analysis.



#### 5. Non-compliance for a particular appliance (make-wise)

- This graphical representation of this analysis is done assuming that a certain no. of non-compliances have been observed in inspections done in a certain period of time as per the make of the appliance.
- The values represented by the analysis are hypothetical, assumed only to pictorially represent the analysis.



## 2.2. Verification testing process

Verification testing is conducted to physically verify whether the performance of the appliance is as described by the label approved by MEA. This involves procurement of samples and performing verification testing in independent accredited laboratories.

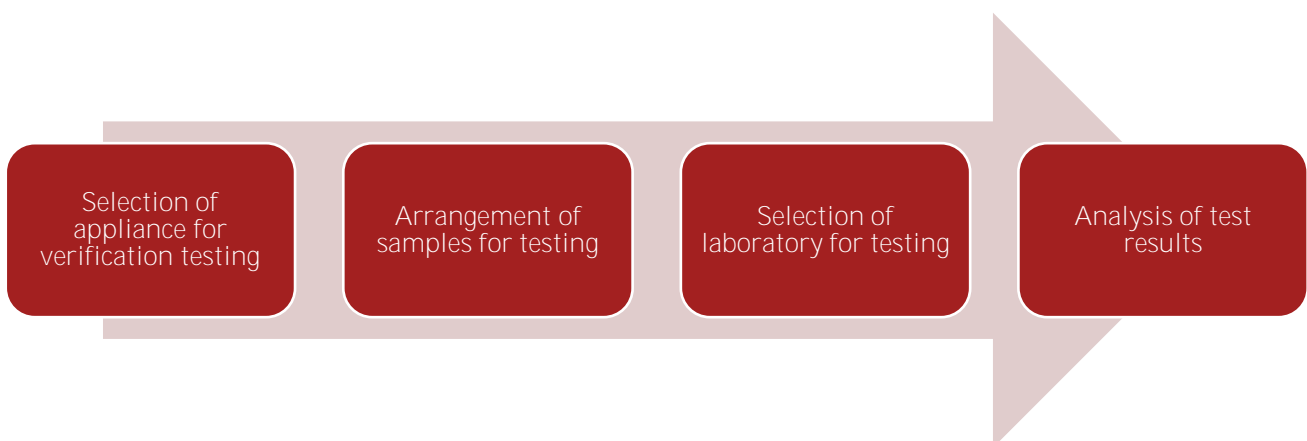


Figure 7: Verification testing process

### 2.2.1. Selection of appliance for verification testing

Selection of appliance refers to the process of identifying appliances which needs to be tested for evaluation of compliance with energy efficiency standards. The selection shall be made such that a mix of different types and makes of the appliances covered under the labelling programme could be tested. The selection can be either through random or stratified sampling or there could be a scenario for challenge verification. These are explained next:

- Random sampling: The database for appliance that have been approved under the labelling programme available with MEA and the database for approved products models that have been imported in the country available with MCS are referred. Based on the databases a list of appliance product models is formed which are approved and available for sale in the country. Based on this list a specific sample of appliances are randomly selected for verification testing.
- Stratified sampling: The list of appliances prepared from the databases is referred to identify specific **strata's based on the appliance make, source country, capacity, importer's name, type, etc.** Then depending upon the budget specific sampling is done to list out the appliances which needs to undergo verification testing.
- Challenge testing occurs when MEA receives a tip-off regarding an appliance/ model deliberately failing to meet the labelling requirements.

### *2.2.2. Arrangement of samples for testing*

The appliances selected for verification testing in the previous step needs to be arranged for verification testing. This arrangement could be made either through purchasing the samples for the market place or seeking the support from importers /exporters to provide the samples for FOC basis. The decisions on the process to be adopted for arrangement of samples rests with MEA.

In case of purchasing the samples from market place, the inspection team shall purchase the model and inscribe special markings on the sample such that the particular model can be identified easily. Once the markings are **completed, the model shall be brought to MEA's office/ warehouse by the inspection team.**

In case of seeking the support from importers /exporters for arranging the samples, the list of appliances required shall be shared with the respective importer and/or exporter. The contact information submitted by the applicants to MEA during the stage for seeking approval for products under the labelling programme shall be used for contacting the respective importer /exporter. Only those appliances which have been covered under the labelling programme and are affixed with Maldives EE label shall be supplied by the respective importer/exporter.

For the verification testing, it is proposed that 1 sample of each product type shortlisted for testing shall be tested initially.

### *2.2.3. Selection of laboratory for testing and shipping*

Once the samples for testing have been procured, marked and stored in the MEA office or warehouse, the next step is selection of an appropriate test facility for testing and shipping of samples to the respective laboratories.

*A widely accepted concept for compliance check testing in standards and labelling programs is empanelment of few test laboratories by the implementing body. The implementing body generally floats a tender, inviting test laboratories to apply for empanelment under the standards & labelling programme. The implementing body and the test laboratory can enter into a rate contract for testing of particular appliances.*

However, this approach may not be the most ideal for the Maldives, due to unavailability of local testing facilities in the country. Therefore, potential alternative approaches are mentioned below:

- Testing is conducted at an appropriate laboratory in a nearby country. The cost of transportation of samples and testing are borne by MEA. Since the cost of transport of samples is expected to be high, it is recommended that multiple appliance models are shipped together for testing, to reduce the fixed cost base.
- In long run, developing an in-house testing facility to test the products locally will be an ideal strategy.



It is proposed that initially the verification testing shall be done in international test facilities. The entire operations for verification testing including its cost is closely monitored to avoid any intermediate hurdles and time lags. The results from the verification testing is monitored to evaluate whether the products are qualifying **on energy efficiency criteria's respectively for separate categories. Based on the overall process the MEA shall** evaluate the need for developing an in-house test facility in consultation with stakeholders. The assessment should be made based on the benefits of building an in-house facility and achieving the break-even of the cost to be incurred in establishment of test facility.

Following is the list of a few potential labs in nearby countries:

Sr. No.	Laboratory	Location	Appliance
1	Beijing Testing and Inspection Station for Household Electric Appliances BTL Inc. (Dongguan)	China	AC
2	Bureau Veritas Consumer Products Services (Guangzhou) Co., Ltd Science City Branch	China	AC
3	Guangzhou Vkan Certification & Testing Institute	China	AC
4	Hangzhou Yinghua Technology Service Co.	China	Refrigerator
5	Intertek Testing Services (Hangzhou) Limited	China	Refrigerator
6	Intertek Testing Services Shenzhen Ltd. Guangzhou Branch	China	AC, Refrigerator, Washing Machine, Tumble dryer
7	Intertek Testing Services Ltd., Shanghai, China	China	AC, Refrigerator, Washing Machine, Tumble dryer
8	TUV Rheinland (Guangdong) Co., Ltd	China	AC
9	TUV Rheinland (Shenzhen) Co., Ltd.	China	AC
10	Suzhou UL-CCIC Company Limited	China	AC
11	Guangzhou UL-CCIC Company Limited	China	AC
12	SGS-CSTC Standards Technical Services Co., Ltd. Guangzhou Branch Testing Center	China	Refrigerator
13	SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch Testing Center	China	AC, Washing Machine
14	TUV SUD Certification and Testing (China) Co., Ltd. Shanghai Branch	China	Refrigerator
15	Ningbo Entry-Exit Inspection and Quarantine Bureau Technical Center / Ningbo Joysun Product Testing Service Company	China	AC
16	TUV SUD Certification and Testing (China) Co., Ltd. Guangzhou Branch	China	AC
17	DEKRA Testing and Certification (Shanghai) Ltd. Guangzhou Branch	China	AC
18	Anhui CQC-CHEARI Technology Co., Ltd	China	AC
19	LCIE China Company Limited	China	AC
20	VDE Testing and Certification Institute	Germany	AC

21	The Hong Kong University of Science and Technology	Hong Kong	AC
22	Intertek Testing Services Hong Kong Limited	Hong Kong	Refrigerator
23	Sierra Aircon Pvt Ltd	India	AC, Refrigerator
24	Intertek Commercial & Electrical - New Delhi	India	AC
25	UL India Private Limited	India	Refrigerator
26	Central Power Research Institute , Ministry of Power, Govt. of India	India	AC, Refrigerator
27	UL International Italia S.R.L	Italy	Refrigerator
28	Nemko Korea Co.,Ltd	Korea	AC
29	TUV SUD PSB Pte Ltd	Singapore	Refrigerator
30	Setsco Services Pte Ltd	Singapore	Tumble Dryer
31	Taiwan Electric Research & Testing Center Guanyin Safety and EMC Testing Laboratory	Taiwan	AC
32	Intertek Testing Services (Thailand) Ltd	Thailand	AC
33	TUV SUD (Thailand) Limited	Thailand	Refrigerator
34	Underwriters Laboratories, INC. Plano, TX	United States of America	AC
35	Korea Testing Laboratory	S. Korea	AC, Refrigerator, Washing Machine
36	Korea Apparel Testing & Research Institute	S. Korea	Washing Machine
37	Intertek	S. Korea	AC, Refrigerator, Washing Machine
38	Korea Refrigeration & Air-conditioning Assessment Center,	S. Korea	AC, Refrigerator
39	Busan Techno Park, Korea	S. Korea	AC, Refrigerator
40	Korea Testing & Research Institute	S. Korea	AC, Refrigerator
41	Korea Electric Testing Institute	S. Korea	Refrigerator

#### *2.2.4. Analysis of test results and enforcement*

Once the test reports are generated by the laboratories, MEA officials shall verify whether the performance of the model meets that indicated by the label approved by MEA for that model. In case the test results of a product model indicates that the performance is as per the label within the specified limits, the product model is deemed to have passed the verification test.

However, if the model fails to meet the requirements, then the MEA shall consider following options while deciding the course of actions:

- Option 1: Two more samples of the appliance model shall be arranged from the market place. The sample are sent for verification testing in either the same laboratory where the product models was initially tested or different laboratory (all laboratories should be accredited with a common accreditation system). If both the models meet the EE labelling requirements and energy efficiency grade, the model

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will be deemed to have been compliant with the labelling requirements. Otherwise, the model will have been deemed to fail to meet the requirements. In this option, all subsequent testing and transport costs shall be borne by the importer of the product.

- Option 2: The importer and MCS is informed about the failure of product model under verification testing. The importer shall be provided an opportunity to arrange for fresh testing of the respective product model either by themselves or their counter parts in other countries. The importer shall be advised to hold the import of that particular product model until the revised test report /energy efficiency grade application (if there are any changes) is submitted and approved by MEA. The MCS shall be informed to hold the clearance of the particular product model (which has failed in verification testing).

### *2.3. MEA conducts enforcement*

The enforcement refers to the actions required by MEA to ensure adherence to the requirements of EE labelling programme once the regulation is enforced.

The EE labelling regulation (once enforced), will mandate that MEA /concerned body to impose penalties on applicants of labelling programme whose appliances are found to be non-compliant with the provisions of the regulation.

It is proposed that, an applicant who has the approval for EE label for the product model (s) which have failed the market surveillance, is supposed to stop marking his products with the EE label and intimate MEA of the same. Stop marking notice is generally issued on account of failure of samples in verification testing – as discussed in option 2 of section 2.2.4

The corrective actions should be taken and information shall be submitted to MEA.

The details regarding penalty provisions are discussed separately in chapter 5 of this document.

### 3. Roles and responsibilities of government stakeholders in market surveillance

This section describes the roles and responsibilities of different stakeholders in monitoring and enforcement of the EE labelling programme.

The expected roles and responsibilities of various stakeholders are described below.

*Table 3: Roles and responsibilities of stakeholders*

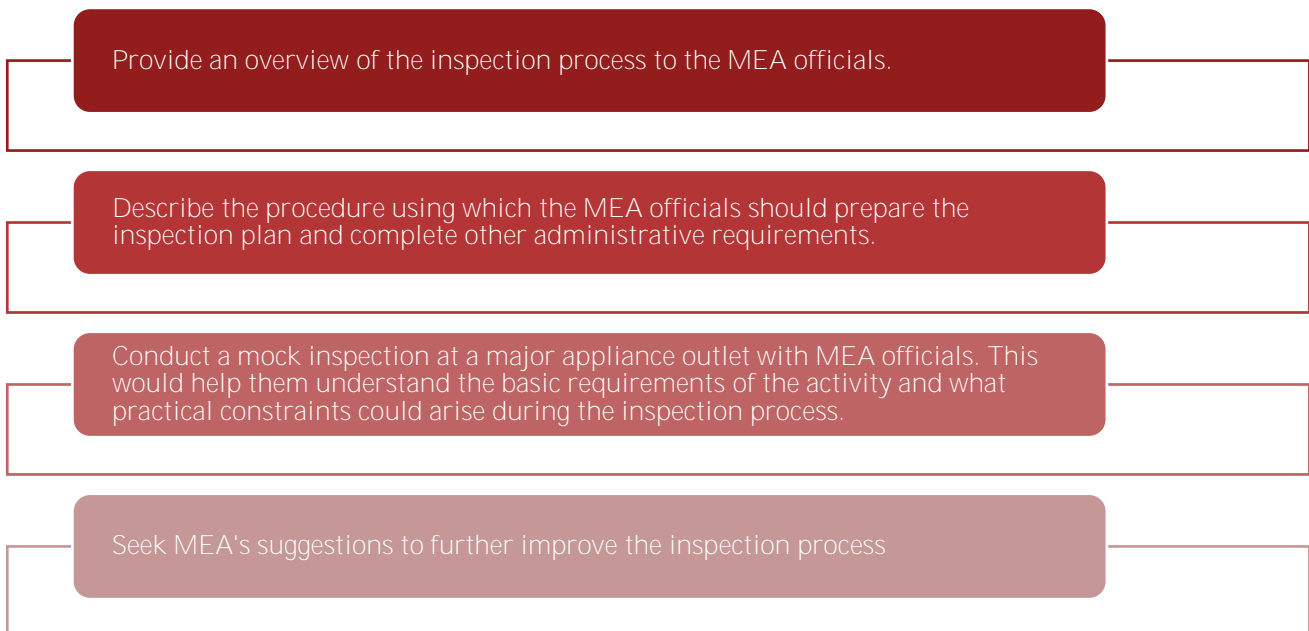
Stakeholder	Role	Major responsibilities
Ministry of Environment (ME)	Development of the program and revision	<ul style="list-style-type: none"> <li>Develop the standards and labelling program</li> <li>Revise the program accordingly</li> </ul>
Maldives Energy Authority (MEA)	Main implementing organisation	<ul style="list-style-type: none"> <li>Responsible for overseeing and executing the market surveillance activities</li> <li>Conduct regular label verification inspections in the marketplace</li> <li>Administer the arrangement of samples from the marketplace or other sources for verification testing</li> <li>Coordinate with labelling authorities from other countries for any information that may be useful for the market surveillance</li> <li>Maintain list of accredited laboratories for verification testing</li> <li>Coordinate with MCS to ensure that only labelled appliances enter the Maldivian market</li> <li>Oversee smooth implementation of the EE labelling programme</li> </ul>
Maldives Customs Services (MCS)	Regulatory authority over import of labelled appliances, working under MED	<ul style="list-style-type: none"> <li>Work with MEA to ensure that only labelled appliances enter the Maldivian market</li> <li>Conduct regular inspections of shipments to be imported as per mandate</li> </ul>
Retailers / importers	Targeting the consumers that are the audience of the labelling scheme. Can be either state controlled STOs, or private importers	<ul style="list-style-type: none"> <li>Support MEA and MCS during the inspection/ market surveillance process.</li> <li>To work with the MCS while importing the appliances by providing the particular details required to check the energy efficiency of the product.</li> </ul>
International test labs	Carrying out the performance and safety tests for the sample of the appliances that are to be imported into the Maldives	<ul style="list-style-type: none"> <li>To carry out the performance and safety tests for the appliances that are being imported to the Maldives.</li> <li>To work with the MEA and the MCS to provide the details of the tests conducted while the search and inspection of the products done at the customs.</li> </ul>



## 4. *Demonstration of market surveillance process and procedure*

The project team shall carry out a demonstration of the market surveillance process in front of relevant authorities such as the MEA to evaluate the workability and effectiveness of proposed process. This would provide more confidence amongst stakeholders for conducting label verification and help the team identify the various practical issues and constraints that the inspection team is likely to face during their visits to retail stores.

The agenda of the visits is defined in the figure below:



*Figure 8: Agenda of demonstration of market surveillance process*

This chapter provides a brief synopsis of the steps to be followed during the market surveillance demonstration.



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## 5. Regulatory changes to impose penalties, and recommendations for penalties

### 5.1. Existing penalties in the Maldives under Customs regulation

Currently, Customs may penalize the parties in the following ways, depending on the severity, for infringing the Customs Law and Regulations.

- Notify to correct by advice
- Fine
- Temporary withholding of the license or registry or pass issued by the Customs.
- Invalidate the license or registry issued by the Customs
- Send the case to the Prosecutor General Office to file a lawsuit in court, after the investigation.

The penalties can be levied in the following situations:

#### 1. Penalties for excess goods than declaration

Goods shall be considered as excess goods when the goods in the shipment exceeds the goods declared in the declaration furnished for any shipment under the airway bill or bill of lading, in circumstances where more than one shipments is imported under one air way bill or bill of lading.

Fine shall be imposed on excess goods whose Customs approved value of F.O.B is equal to or more than 10 (ten) percent of the total value declared for the goods involving excess goods, if the goods imported to Maldives is an excess good.

- Goods exceeding for the first time, shall be liable on conviction for a fine that is 25% (twenty five percent) of the Customs approved total value of F.O.B of the excess goods.
- Goods exceeding for the second time, shall be liable on conviction for a fine that is 35% (thirty five percent) of the Customs approved total value of F.O.B of the excess goods.
- Goods exceeding for the third time and every additional time, shall be liable on conviction for a fine that is 50% (fifty percent) of the Customs approved total value of F.O.B of the excess goods.

#### 2. Furnishing false information to the Customs

This is defined as increase in the price of the goods due to the changes in the information about of the type, brand, model or serial number or specific information alike of the goods declared in the declaration furnished for import and export to and from the Maldives, mismatches with the goods in the shipment.

Fine shall be imposed in the following ways on goods arrived with the shipment related to false information, if their value of F.O.B is equal to or more than 10 (ten) percent of the Customs approved total value of F.O.B of the goods involving false information:

- Furnishing false information for the first time, shall be liable on conviction for a fine that is 15% (fifteen per cent) of the price of F.O.B of the goods involving false information.
- Furnishing false information for the second time, on conviction the person shall be fined with 25% (twenty five per cent) of the price of the F.O.B of the goods involving false information.

- Furnishing false information for the third time and each additional time if such an act is repeated a fine of 50% (fifty per cent) of the price of the F.O.B of the goods involving false information.

### 3. Penalties and punishments for other offences

Other penalties and provisions exist for:

- Broken seal affixed by the customs.
- Non declared items.
- Unauthorized persons, vehicles and crafts.
- For items arriving with no inward clearance.
- For items arriving via smuggling.
- For items arriving via unofficial ports.

The penalties range from Ruffiya 5000 to Ruffiya 40000.

## *5.2. Recommendations on penalties for non-compliance under S&L programme*

In case the non-compliance has been established under the market surveillance activity, the applicant of the **respective product label shall be penalized. The provisions of penalty as defined under the Customs' law shall be imposed** as applicable. Further, the following actions are proposed pertaining to the S&L programme:

- The approval provided for affixing the energy efficiency label on the respective product shall be withdrawn.
- The applicant of the label shall be informed to stop the sale of products of the respective appliance model with immediate effect.
- Information about the non-compliance with details of product model (s) and name of the importer /applicant shall be published in local news for the information of consumers.
- For any applicant, if there are events /occurrence of non-compliance 3 times in a financial year, then the respective applicant shall be barred from applying to S&L programme for a certain period as may be prescribed by MEA.

It is proposed that MEA, ME and other stakeholder shall deliberate on this matter to finalise the list of penalty provisions.



# Appendix A. - Inspection plan template

For inspection year : \_\_\_\_\_

Inspection plan approval date : \_\_\_\_\_

Inspection target for the financial year

Parameter	Value
Number of general inspections	
Number of targeted inspections	
List of target appliances	1. 2. 3.
Number of warehouse inspections	
Number of market place inspections	
Number of Port inspections	

Tentative inspection plan

Month	Locations to be visited	Estimated cost for the month (MVR)
August		
September		
October		
November		
December		
January		
February		
March		

Total estimated budget : \_\_\_\_\_

Name of Inspection Officer

Signature & Seal



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## Appendix B. - Location visit template

Date: \_\_\_\_\_

### Inspection Details

Type of inspection:            General inspection/ Targeted inspection

Reason for conducting inspection:-

Inspection location:            \_\_\_\_\_

Point of inspection:            Marketplace/ Warehouse/ Port

Inspection team:-

- Number of inspection officers: \_\_\_\_\_
- Name of inspection officers: \_\_\_\_\_

Date of inspection:            \_\_\_\_\_

Tentative time:                \_\_\_\_\_

Notice required:                Yes/ No

Name and designation of officer preparing the plan: \_\_\_\_\_

Signature: \_\_\_\_\_

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# *Appendix C. - Template for authorizing inspection officers*

Date:

Sub: Approval for inspection

To whomsoever it may concern,

This is to certify that Mr./Mrs./Ms. \_\_\_\_\_ is hereby authorized to conduct inspection to check for compliance of equipment as per the EE labelling scheme at \_\_\_\_\_ on the \_\_\_\_\_ day of the month of \_\_\_\_\_, 20\_\_.

You are requested to kindly cooperate with the inspection process so that he/she may discharge their duties as inspection officers. Please note that willingly stopping them from carrying out their duties may result in prosecution in a court of law.

Signature

Name of Officer:

Seal

## Appendix D. - Inspection report template

Date: \_\_\_\_\_

Name of inspection officer \_\_\_\_\_

Date of inspection \_\_\_\_\_

Inspection location \_\_\_\_\_

Name of store/warehouse \_\_\_\_\_

Findings of inspection

S. No.	Appliance	Manufacturer	Model	Inspection result	Remarks

Recommendation for further action

Signature & seal

# Appendix E. - Review of MV&E practice under S&L programme of key countries

## Introduction

The project team carried out a review of MV&E practices followed for international S&L programmes in order to understand the different provisions of MV&E implemented in other parts of the world, and which of these provisions can be applied to the Maldivian context.

To this end, S&L programmes implemented across five countries were studied by the project team. These are listed in the following figure.

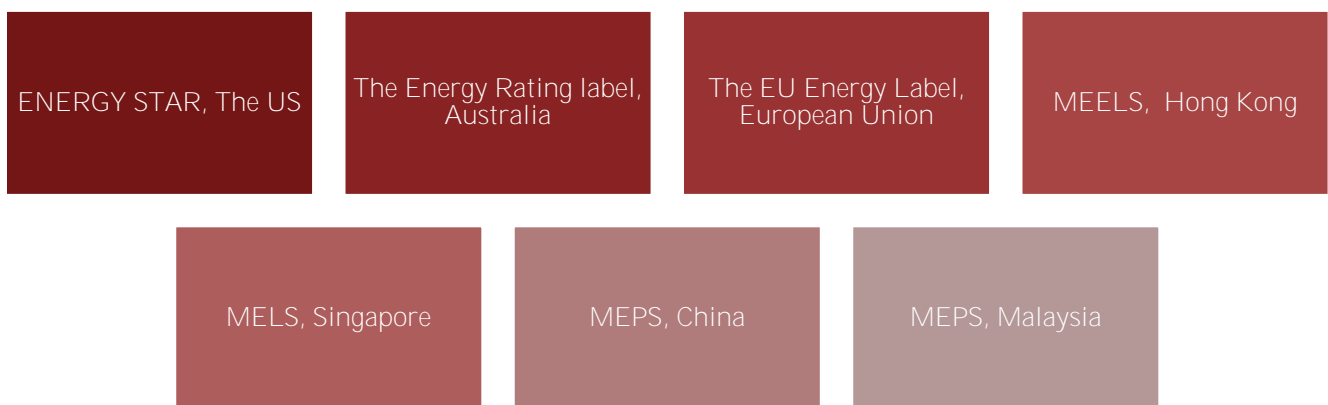


Figure 9: S&L programmes reviewed for Monitoring framework

## The US: ENERGY STAR

ENERGY STAR is a voluntary S&L programme in the US established in 1992. Jointly developed by DEA and EPA, the programme aims to save costs and help protect the environment through energy-efficient products and practices.

The ENERGY STAR label is an endorsement labelling programme, and is established to achieve the following objectives:

- Reduce greenhouse gas emissions and other pollutants caused by the inefficient use of energy
- Make it easy for consumers to identify and purchase energy-efficient products that offer savings on energy bills without sacrificing performance, features, and comfort.<sup>1</sup>

The ENERGY STAR labelling programme is voluntary and covers a wide range of products, including lighting technologies, refrigerators, heating equipment, etc.

<sup>1</sup> Retrieved from: <https://www.energystar.gov/products/how-product-earns-energy-star-label>

## MV&E practices

The key aspects of MV&E practices in the US are as follows:

- The US Energy Star programme follows a third-party verification system<sup>2</sup> wherein the products under the S&L domain are required to supply supporting evidence of compliance with the relevant criteria before being able to use the energy-efficiency label.
- Manufacturers and importers are required to submit an application for registration of the product model to the government authorities. This application shall include the certificate as well as test results obtained from an accredited laboratory.
- Once the products are allowed to affix the Energy Star label, the government regularly surveys the market and conducts verification testing in order to ensure the conformance.
- The EPA monitors the use of the ENERGY STAR mark and name in trade media, advertisements, and the Internet. It conducts semi-annual quality assurance reviews of retail store stock.
- In order to ensure that ENERGY STAR labelled products meet consumer performance expectations on an ongoing basis, a subset of models are subject to verification testing each year.
- The US EPA has defined a complete methodology for ensuring implementation of MV&E regimes specific to product labelling.<sup>3</sup>

## Activities involved in MV&E

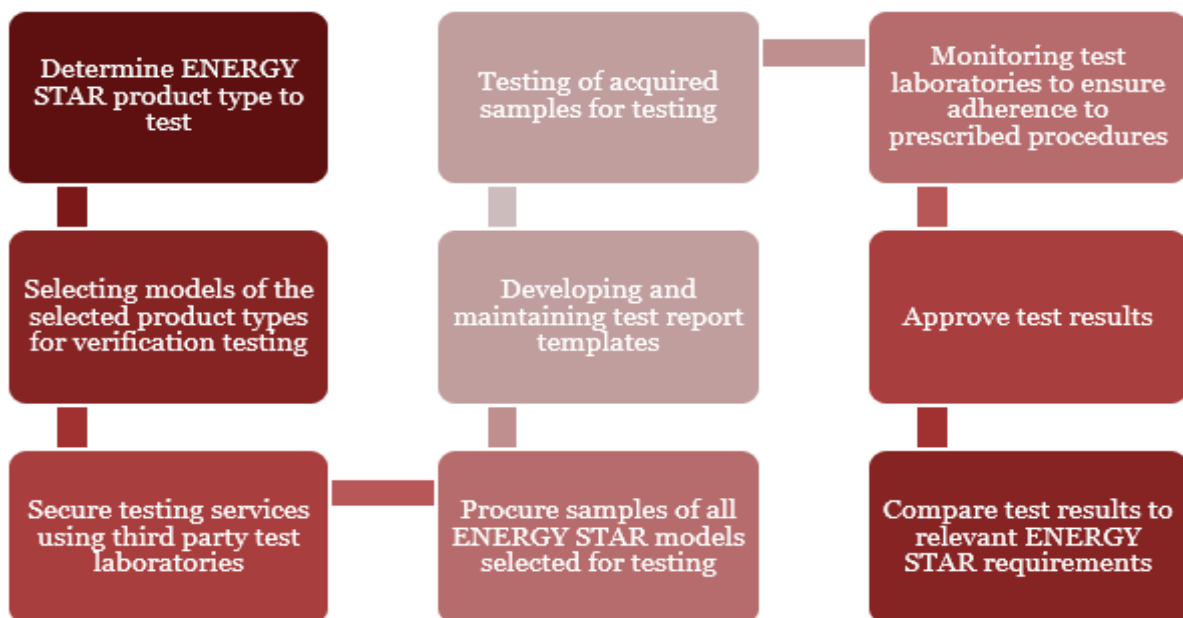


Figure 10: Activities involved in MV&E, the US

The Department of Energy is responsible for approving the laboratory test report. If it is found that a product does not adhere to the required standards, the following actions are taken:

<sup>2</sup> In a third-party verification system, the product model is tested at independent accredited laboratories beforehand in order to check its conformance with the labelling programme requirements. Upon qualifying the requirements, the products are issued a certificate from laboratories.

<sup>3</sup> The information about the product integrity is available in public domain and can be accessed through ([http://www.energystar.gov/index.cfm?c=partners.pt\\_es\\_integrity](http://www.energystar.gov/index.cfm?c=partners.pt_es_integrity))

- 
- The manufacturer is notified by DoE if a model does not meet ENERGY STAR specifications.
  - EPA is notified if the test results indicate that a product is not in compliance with ENERGY STAR specifications.
  - The Federal Trade Commission is notified if test results indicate that a model is not appropriately rated or labelled.

## *Key stakeholders*

### *US DOE<sup>4</sup>*

DOE manages the government-run ENERGY STAR verification programme for DOE-covered products. Its responsibilities include the following:

- Determining which ENERGY STAR product types to test
- Selecting ENERGY STAR models for verification testing based on specific programmatic criteria
- Securing testing services using third-party test laboratories having appropriate capabilities and accreditations
- Procuring all ENERGY STAR models selected for verification testing
- Developing and maintaining test report templates
- Monitoring test laboratories so as to ensure adherence to prescribed test procedures and established quality assurance or quality control programmes
- Approving laboratory test reports

### *US EPA<sup>5</sup>*

EPA is responsible for all enforcement actions under the ENERGY STAR programme, including those resulting from the DOE verification programme. It also oversees the CB verification testing specific to ENERGY STAR products, which includes developing requirements for EPA-recognised CBs, accreditation bodies and test laboratories, providing specific guidance to these parties, and compiling verification test results. EPA also holds regular seminars for the development of CBs.

### *EPA recognised CBs<sup>6</sup>*

EPA-recognised certification bodies are responsible for certifying products that meet ENERGY STAR requirements and report information on those products to EPA. They must verify that test results are from an EPA-recognised laboratory, maintain open correspondence with EPA, and cooperate with their accreditation bodies for ongoing accreditation. CBs are also responsible for administering verification testing and challenge testing.

For products tested by DOE under the ENERGY STAR verification programme, DOE pays all the costs for obtaining and testing products. Verification programmes administered by CBs are partner-funded.

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<sup>4</sup> Retrieved from: [http://energy.gov/sites/prod/files/2013/12/f5/estar\\_verification\\_process.pdf](http://energy.gov/sites/prod/files/2013/12/f5/estar_verification_process.pdf)

<sup>5</sup> Retrieved from: [http://energy.gov/sites/prod/files/2013/12/f5/estar\\_verification\\_process.pdf](http://energy.gov/sites/prod/files/2013/12/f5/estar_verification_process.pdf)

<sup>6</sup> Retrieved from: [http://www.energystar.gov/index.cfm?c=third\\_party\\_certification.tpc\\_cert\\_bodies](http://www.energystar.gov/index.cfm?c=third_party_certification.tpc_cert_bodies)



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## Managing disqualifications<sup>7</sup>

Product disqualifications are a result of performance testing failures under one of the verification testing efforts. They include the following:

- Third-party verification testing
- CFL third-party testing
- Quality assurance lighting programme
- DOE appliance testing for refrigerators, dish washers, clothes washers and room ACs

### Other actions taken

- Qualified Product List updated: When a determination to disqualify is finalised, the model is removed from the ENERGY STAR Qualified Products List. EPA notifies the associated CB to disqualify the model in CB product lists.
- **ENERGY STAR integrity webpage updated:** Once the product has been removed from the ENERGY STAR Qualified Products List, EPA posts the model on its list of disqualified products on the ENERGY STAR programme integrity webpage. **This webpage provides consumers and utilities with information regarding models that no longer meet product standards.**
- **Utilities notification:** On a monthly basis, those utilities that have opted for regular product disqualification updates receive notice of product categories affected by disqualifications during that period.

### Compliance monitoring

As part of its broader effort to ensure proper use of the ENERGY STAR logo, EPA supports a number of initiatives that help ensure that the label is effectively removed from disqualified products.

- Retail store-level assessment (RSL): The RSL project involves a broad market review of retail-shelf products, twice a year, in major retailers across the US to identify products improperly labelled as ENERGY STAR. It also includes a more focussed review of retail shelves and online sources in order to identify any disqualified models that continue to be advertised or labelled as ENERGY STAR products.
- Commercial food services (CFS) monitoring: The CFS project reviews the use of the ENERGY STAR logo in the CFS industry, including at trade shows, and through catalogue and website marketing in order to ensure that only qualified products are labelled and marketed as ENERGY STAR.
- Customs port inspections: ENERGY STAR works closely with US customs to support the examination and seizure of disqualified products labelled as ENERGY STAR arriving in US ports.

## Australia: The Energy Rating label

The E3 program is a cross-jurisdictional programme through which the Australian government, states and territories and the New Zealand government collaborate together to deliver a single, integrated programme on energy-efficiency standards and energy labelling for equipment and appliances.

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<sup>7</sup> Retrieved from:  
[http://www.energystar.gov/ia/partners/third\\_party\\_certification/downloads/Disqualification\\_Procedures.pdf?ce92-3df1](http://www.energystar.gov/ia/partners/third_party_certification/downloads/Disqualification_Procedures.pdf?ce92-3df1)

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On 1 October 2012, the GEMS Act came into effect, creating a national framework for energy efficiency in Australia. The GEMS Act is the underpinning legislation for the E3 program in the country. The E3 programme remains the delivery mechanism for appliance and product energy efficiency and now covers 22 different product types with other products currently under investigation.

### Programme objectives

The E3 program was drafted with the following objectives:

- To reduce energy bills for households as well as businesses in a cost-effective way by driving improvements to energy efficiency of new appliances and equipment sold
- To improve the energy efficiency of new appliances and equipment that use energy and to also improve the energy performance of products that have an impact on energy consumption
- To reduce appliance and equipment-related greenhouse gas emissions through a process which complements other actions by jurisdictions

### Programme governance and implementation

In 2012, the Commonwealth and the state and territory governments signed the Inter-Governmental Agreement for the GEMS Legislative Scheme. This was accompanied with the introduction of the national GEMS Act in 2012, where states and territories agreed to a single national regulatory approach rather than each state introducing its own set of regulations.

The Inter-Governmental Agreement sets out the governance arrangements for the E3 Program and the GEMS Act. The programme is overseen by the E3 Committee, which consists of representatives of the Commonwealth, state as well as territory governments. The committee recommends actions through the Energy Working Group and senior committee of officials to the Commonwealth of Australian Governments Energy Council for decisions.

The Commonwealth Department of Industry and Science implements the E3 Program on behalf of the Commonwealth, state and territory governments. The programme has three main components:

- Policy and information development
- Implementation of determinations
- Compliance

Implementing determinations is the responsibility of the GEMS Regulator. The regulator is based within the Department of Industry and Science and is responsible for administering the GEMS Act, maintaining the GEMS register,<sup>8</sup> monitoring and enforcing compliance with the act, among other things.

### Compliance

The GEMS Regulator, supported by GEMS inspectors vested with inspection, monitoring, and investigation powers, is responsible for monitoring and enforcing compliance under the act through a monitoring programme of the following:

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<sup>8</sup> The GEMS register records information for each registration of a product covered by GEMS determinations. For a GEMS product to be offered for sale or used commercially in Australia it must be on the GEMS register. Data from the GEMS register is an integral component of the product investigation and compliance monitoring processes.

- Market surveillance: Verification activities in order to ensure that GEMS products meet the GEMS registration and labelling requirements
- Check testing: Verification activities, conducted by accredited independent laboratories, to ensure that GEMS products meet GEMS-level requirements, for example, minimum energy performance standards

The GEMS Regulator has a range of response options to non-compliance which include informal educative approaches, administrative and civil actions, and criminal sanctions.

### *Labelling programme under the GEMS Act*

Energy rating labels provide consumers with information on the energy efficiency of a product. There are three types of labels endorsed by the Australian Government:

- The Energy Rating Label
- The Swimming Pool Pumps Label
- The Zoned Energy Rating Label

The Energy Rating Label is a mandatory comparison label. There are also voluntary comparison labels such as the swimming pool pumps label. The Zoned Energy Rating Label is currently being developed for appliances installation locations impact on energy efficiency, performance and energy usage.

### *Monitoring, verification and enforcement (MV&E)*

The key aspects of MV&E practices in Australia (considering refrigerator as a sample case) are as follows:

- The reference standard is AS/NZS 4474.2:2009 (describing performance of household refrigerating appliances - energy labelling and minimum energy performance standard requirements).
- The Australian Government Department of Climate Change and Energy Efficiency to administer the compliance programme on behalf of the E3 Committee.
- The programme has a self-certification system wherein manufacturers and importers are required to register all products covered by the programme before they can be sold. An application for registration and necessary approvals must be submitted to the concerned authority. The application shall include a declaration of compliance with the relevant performance criteria for MEPS and where applicable, labelling and the results of testing and calculations.
- The government provides the authority to affix a label based on the information submitted by the applicants and conducts verification and enforcement checks post labelling.
- The government verifies the claims made by manufacturers and importers through verification testing. Samples of products are arranged from the market, using a sampling process. Verification testing is conducted by independent laboratories.
- Where a product fails an initial screen test on a single sample, a further set of tests on multiple (usually three) samples is used to confirm the non-conformance of the model.
- The government also regularly surveys retail outlets (market survey) for checking compliance with labelling display requirements and to check that all eligible products are registered.

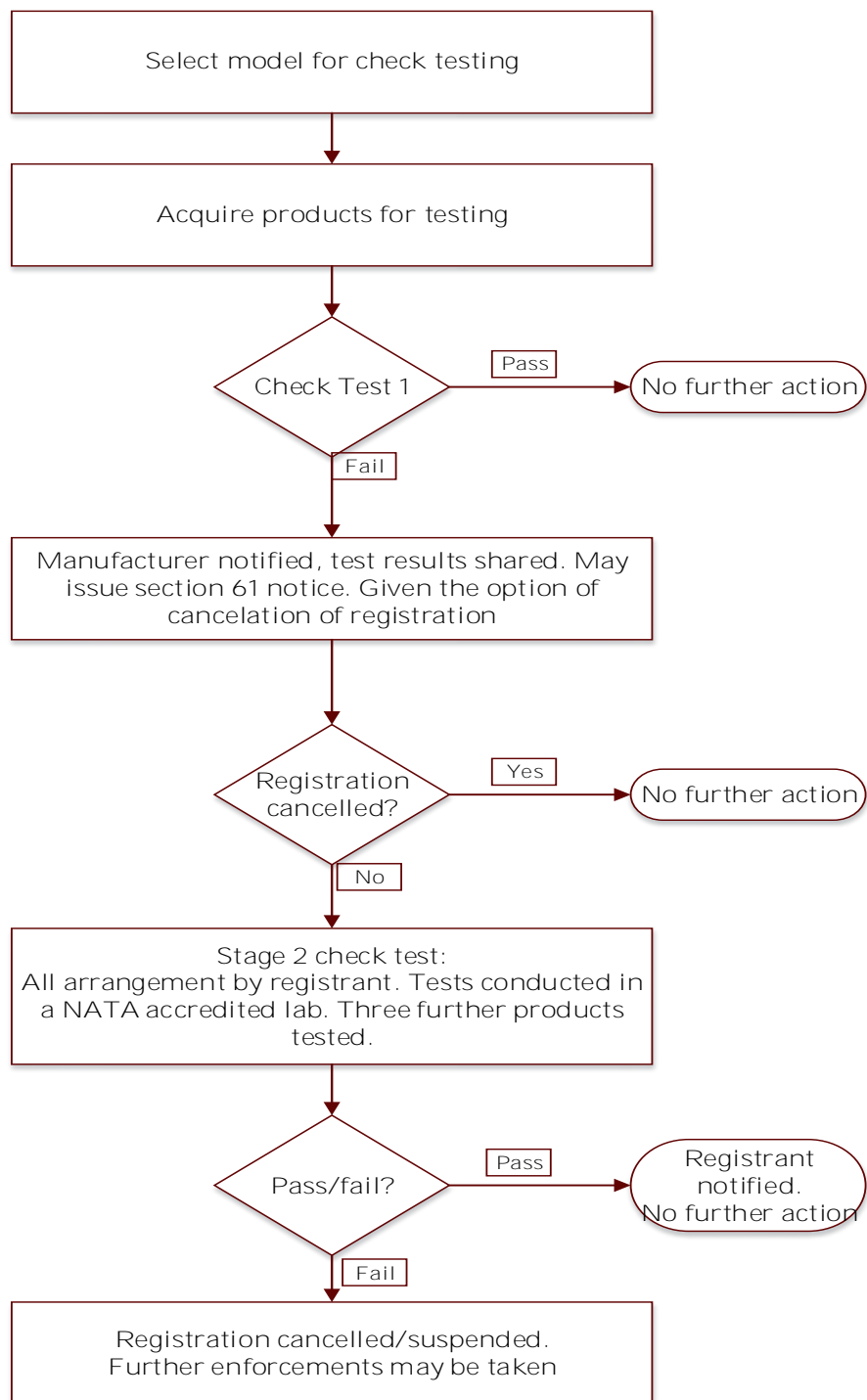


Figure 11: Compliance verification process

Check testing adheres to the following four main steps:

- Selecting models
- Acquiring products of models
- Stage (1) check test

- 
- Stage (2) check test

### Selecting models

The GEMS Regulator selects models for check testing using an intelligence led, risk based approach mentioned in the GEMS Check Testing Selection Criteria.

### Acquiring products

In order to ensure that the products selected for the stage (1) check test are representative of the models registered with the GEMS Regulator, the regulator, where possible, sources products anonymously and directly from the market.

However, in certain circumstances, the manufacturer may be required to provide the product to the GEMS Regulator for verification. Such a scenario may include a possibility where it is not practical to purchase the product.

### Check test stage 1

This test must be conducted by a NATA-accredited test laboratory on behalf of the GEMS Regulator. Usually, a single product is tested in a stage 1 check test. However, for some products, for example, lamps, a single product is not considered representative of the model. In these situations, the relevant determination will determine how many products will be tested.

If the stage (1) check test results reveal that the product meets the requirements of the GEMS determination, then the model passes the test. The GEMS Regulator notifies the registrant and no further action is taken.

However, if the stage (1) check test results reveal that the product does not meet the requirements of the GEMS determination, the registrant is notified and supplied with the test results. The registrant is also given an opportunity to provide information for the GEMS Regulator to consider in deciding whether to issue a notice under section 61<sup>9</sup> of the GEMS Act.

If, after receipt of the section 61 notice, the registrant elects to cancel the registration of the model, then the GEMS Regulator must cancel the registration. The GEMS Regulator may also consider additional enforcement responses.

If the registrant believes that the results of the stage (1) check test do not accurately reflect the model, then the **registrant may arrange for stage (2) check testing at the registrant's expense.**

### Stage (2) check test

The registrant will arrange the stage (2) check test in accordance with the section 61 notice that details, among other requirements, how products will be selected, how many products will be selected, and where these products will be tested.

Three further products are tested. If two out of the three products fail to pass the test, the model fails. If two out of the three products pass the test, the model passes. For products such as lamps, two or three products are not considered representative of the model. In these situations, the GEMS Regulator will determine how many products will be tested.

If the stage (2) check test results reveal that the products meet the requirements of the GEMS determination, then the model passes the test. The GEMS Regulator notifies the registrant and no further action is taken. However, if the stage (2) check test results reveal that the products do not meet the requirements of the GEMS

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<sup>9</sup> A section 61 notice requires that the registrant either elect to cancel the registration of the model or arrange for stage (2) **check testing at the registrant's expense.**

---

determination, then the GEMS Regulator can suspend or cancel the model's registration. The GEMS Regulator may also consider additional enforcement responses.

### *Response to non-compliance*

The GEMS Act provides the GEMS Regulator with a range of response options, including informal educative approaches, administrative and civil actions, and criminal sanctions.

Responses include the following:

- Suspending a registration
- Cancelling a registration
- Enforceable undertakings
- Infringement notices
- Civil penalty order
- Injunctions.

The GEMS Act also allows the GEMS Regulator to publicise details of the enforcement action taken, including the names of persons in relation to whom the action has been taken. In addition, certain adverse decisions relating to the registration of models of GEMS products may be publicised, including the names of registrants.

## *European Union: The EU Energy label*

The energy labelling programme in the European Union is based on the framework that was passed on 28 September 2010. The directive referred to is – Commission Delegated Regulation (EU) No 1060/2010 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of household refrigerating appliances.

The framework directive requires member states to put in place a market surveillance authority (MSA), which has powers to carry out checks on products, request relevant information from manufacturers, and request the withdrawal from the market of non-compliant products. The framework directive is complemented by a delegated regulation which provides information to a specific product category.

### *Introduction to the EU label*

The EU label grades products based on their efficiency of utilisation of energy. The grades range from A to G, A being the most efficient and G the least. However, the revised label contains grades A+++, A++ and A+ as well.

**The label also contains the supplier's name or trademark and model identifier, pictograms highlighting selected performances and characteristics and annual energy consumption in KWh.**

The energy label is currently mandatory for the following product categories:<sup>10</sup>

- Refrigerators
- Wine storage appliances

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<sup>10</sup> Retrieved from: <http://www.newenergylabel.com/uk/timetable>

- 
- Washing machines
  - Televisions
  - Air conditioners
  - Tumble driers
  - Vacuum cleaners
  - Water heaters
  - Ovens
  - Range hoods
  - Dishwashers

## *Stakeholders*

### *Suppliers*

The roles and obligations of the suppliers are clearly mentioned in the respective regulations for each product. These roles and obligations include the following:

- Supply a label with each product, free of charge, to dealers
- Liability for the accuracy of the labels and fiches supplied
- Make available the technical information on request to the authorities of the member states and the European Commission

### *Dealers*

Obligations of dealers are also mentioned in the regulations. They include the following:

- Attaching the label, as provided by suppliers, to the product at the point of sale. The label is to be inserted outside of the front or top of the product, in such a way as to be clearly visible.
- Making available the product fiche in the brochure or in any other literature that accompanies products when sold to end-users.

### *Member states' MSA*

The responsibilities of the MSA include the following:

- Organizing appropriate checks on product compliance, on an adequate scale, and obliging the manufacturer or its authorized representative to recall non-compliant products from the market
- Requirement from the manufacturer or importers concerned to provide all necessary information, as specified in the implementing measures
- Taking samples of products and subject them to compliance checks

## MV&E mechanism<sup>11</sup>

As per the clauses mentioned in the regulations, member states are required to perform market surveillance activity in order to ensure that there are no violations of the provisions mentioned in the respective regulations.

The verification procedure that the authorities of the member states must follow are mentioned in the regulation.

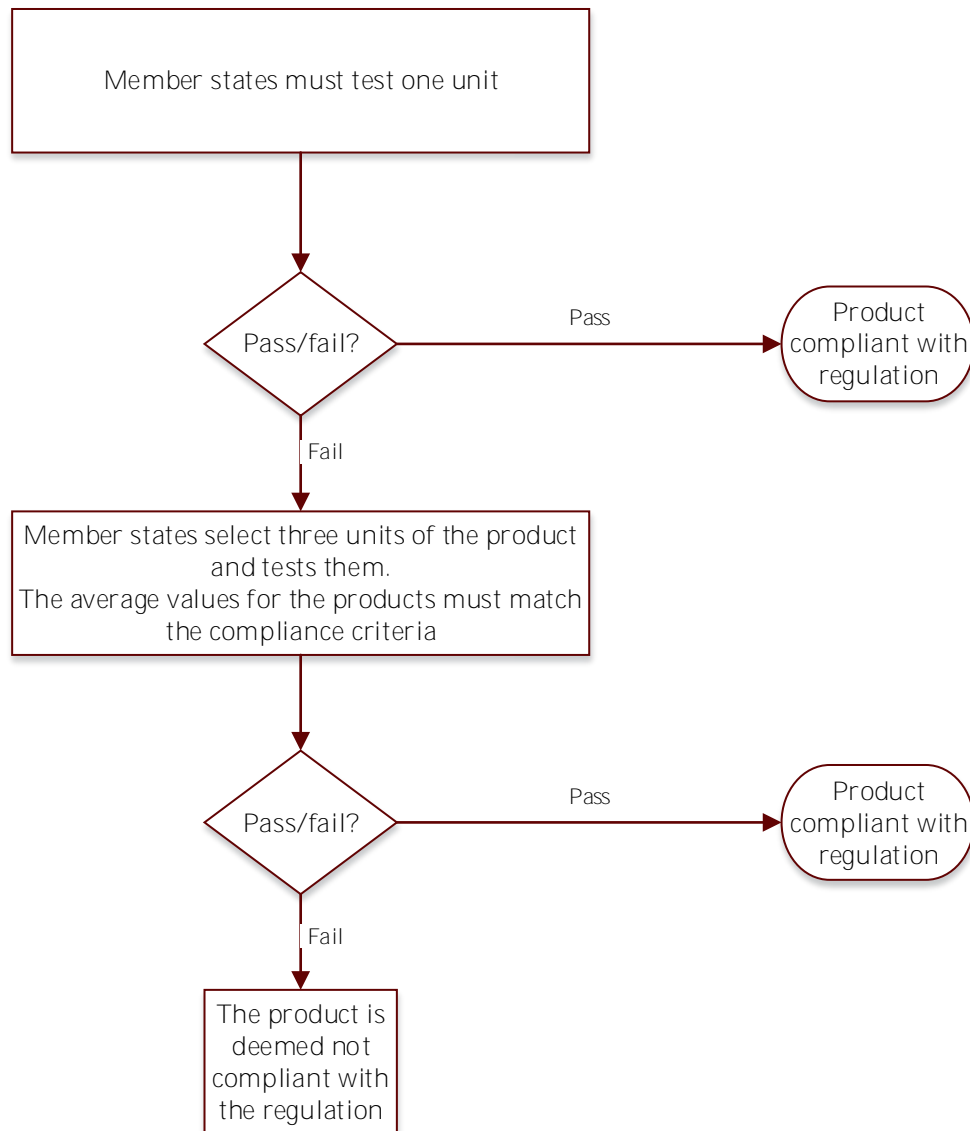


Figure 12: Verification process

## Hong Kong: Mandatory Energy Efficiency Labelling Scheme (MEELS)

The Government of Hong Kong, in 2008, introduced MEELS through the Energy Efficiency (Labelling of Products) Ordinance in order to generate public awareness and promote the use of energy efficient appliances. Under MEELS, it is mandatory to show an energy label for prescribed products for supply in Hong Kong. Under

<sup>11</sup> All the points mentioned in the section refer to the regulation for air conditioners. The document of the regulation can be found by following this link - <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32011R0626&from=EN>



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the ordinance, importers or manufacturers cannot supply a particular product unless it is a listed model with a reference number. The Director of Electrical and Mechanical Services (the Director) is the main authority concerned with MEELS.

Also, the labelling standards are regularly updated to keep up with advancement in technology and current status of market for energy efficiency in Hong Kong.

### Label design

The label contains the following information:

- Energy efficiency grade from 1 to Grade 5, grade 1 being the most efficient and grade 5 the least
- Estimate of annual energy consumption
- Product information such as brand, reference number, etc.
- Product specific details

### Products covered<sup>12</sup>

Two phases of the MEELS programme have been fully implemented and the following products are covered in its scope:

- Air conditioners
- Refrigeration appliances
- CFLs
- Washing machines
- Dehumidifiers

For supply in Hong Kong, the above-mentioned products are required to be listed models with reference numbers and bear energy labels.<sup>13</sup>

### Registration process

A person who wishes to register a product must submit the specified information and documents to the Director of Electrical and Mechanical Services. A guideline document specifying all the necessary details and procedures for registration of a model under MEELS is available on the MEELS website. The format of the forms and other relevant documents are also available.

The entire process is explained in brief below.

- Form 1<sup>14</sup> must be completed for each different model that has to be registered.
- The technical details must be separately provided in the associated schedules.
- The completed Form 1, along with the required documents, must be submitted to the Director in accordance with the Ordinance.

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<sup>12</sup> Retrieved from: <http://www.energylabel.emsd.gov.hk/en/about/background2.html>

<sup>13</sup> The complete list of products is available at the official MEELS website – [www.energylabel.emsd.gov.hk](http://www.energylabel.emsd.gov.hk). The list is updated on a weekly basis.

<sup>14</sup> Retrieved from: [http://www.energylabel.emsd.gov.hk/en/doc/Form\\_1\\_\(201511\).pdf](http://www.energylabel.emsd.gov.hk/en/doc/Form_1_(201511).pdf)

- The Director then assigns a reference number to the model in the name of the person who made the submission and issues a letter of notification informing him of that reference number.

## *Stakeholders*

### *The Director*

The Director of Electrical and Mechanical Services Department of Hong Kong has been given the responsibility for the overall management of the MEELS programme. The roles and responsibilities of the Director include but are not limited to the following:

- Issuance of registration numbers to various products and their enlistment
- Maintaining a list of recognised laboratories
- Maintaining a list of registered models
- Routinely selecting samples of listed models for compliance monitoring by independent laboratories
- Take enforcement actions such as serving improvement notices, prohibition notices, removing the reference number of a listed model from the record etc. if the relevant requirements in the ordinance are not complied with
- Overall management of the programme

### *Specified person*

A person who has submitted the documents for registration of the product under the ordinance is referred to as the specified person. His duties include the following:

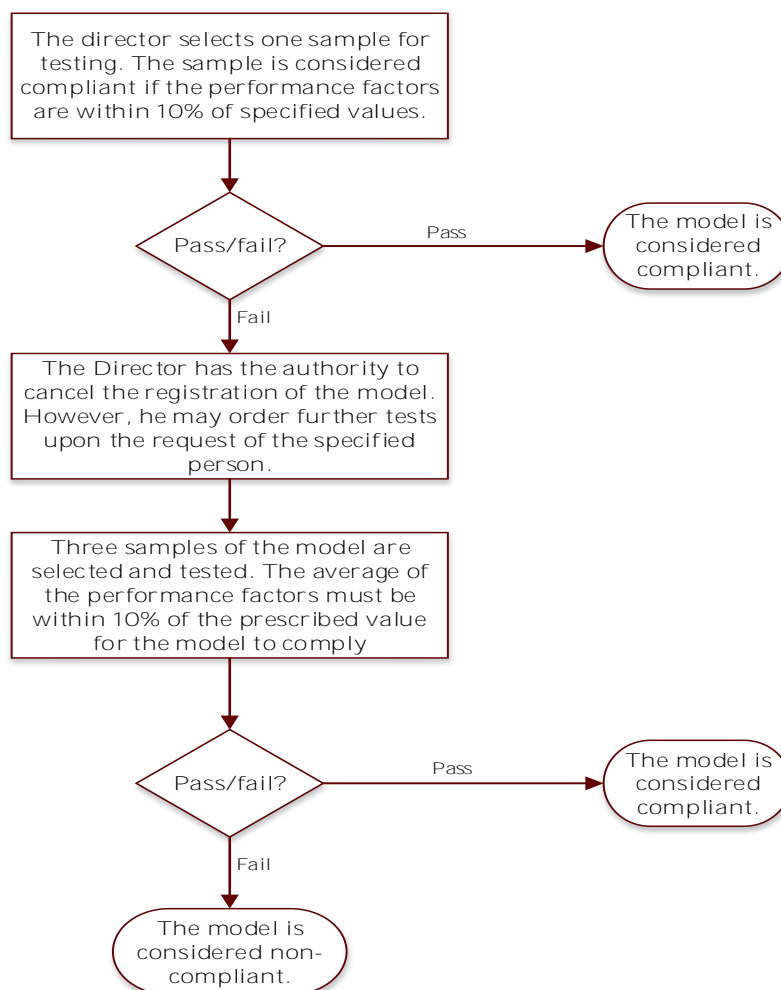
- Ensuring that the prescribed products of the listed model conform to the requirements under the ordinance
- Ensuring that any updates to the registered products are reported to the Director
- Ensuring that the information set out on an energy label conforms to the performance of the product

## *MV&E*

The key aspects of MV&E practices in Hong Kong (considering refrigerator as a sample case) are shared below:

- The governing law is the Energy Efficiency (Labelling of Products) Ordinance that was passed in May 2008. The products that come under the purview of the ordinance are mentioned in its Annexures.
- The ordinance specifies that the Director of Electrical and Mechanical Services Department (the Director) is responsible for the enforcement of the scheme.
- The programme has a self-certification system wherein the manufacturers and importers are required to register all products covered by the programme before they can be sold. An application for registration and necessary documents must be submitted to the Director.
- The Director provides the authority to affix the label based on the information submitted by the applicants and conducts verification and enforcement checks post labelling. The Government of Hong Kong has published a Code of Conduct to guide stakeholders for discharging their duties.

- The Director is authorised to conduct compliance monitoring in order to verify the claims made by manufacturers and importers through verification testing. The samples of products are arranged from the market. The procedure is mentioned in the Code of Conduct.
- Where a product fails an initial screen test on a single sample, a further set of tests on multiple (usually three) samples is used to confirm the non-conformance of the model.



*Figure 13: Compliance monitoring structure*

As per the ordinance, the Director is responsible to conduct compliance monitoring for models that are listed and registered. A brief outline of the process for compliance monitoring for air conditioners is described below:

- The Director initially orders a performance test on one sample of the product to be tested. The sample is considered compliant with the ordinance if the test results are within a tolerance limit of 10%.
- If the sample fails to pass the test, the Director may remove the model from the list of registered products. However, the specified person may provide an explanation of why the samples failed to pass the **compliance test and may opt for further testing of the model for the Director's consideration.**
- If further testing is approved, three samples are tested. The cost for the same must be borne by the specified person.
- The model is only considered complaint with the requirements of the ordinance if the average of the performance factors of the three models is within a tolerance limit of 10%.

## Violations

Any person who contravenes the requirements commits an offence of the ordinance and is liable to a maximum fine of 100,000 HKD upon conviction.<sup>15</sup>

## Singapore: Mandatory Energy Labelling Scheme

The Government of Singapore introduced the Mandatory Energy Labelling Scheme (MELS) in 2014 for regulated goods to help consumers compare the energy efficiency and make more informed purchasing decisions. Under MELS, the appliances were subjected to a comparative label, which uses a tick rating system, ranging from 1 tick (worst) to 5 ticks (best)

### Stakeholders

#### National Environment Agency, Singapore

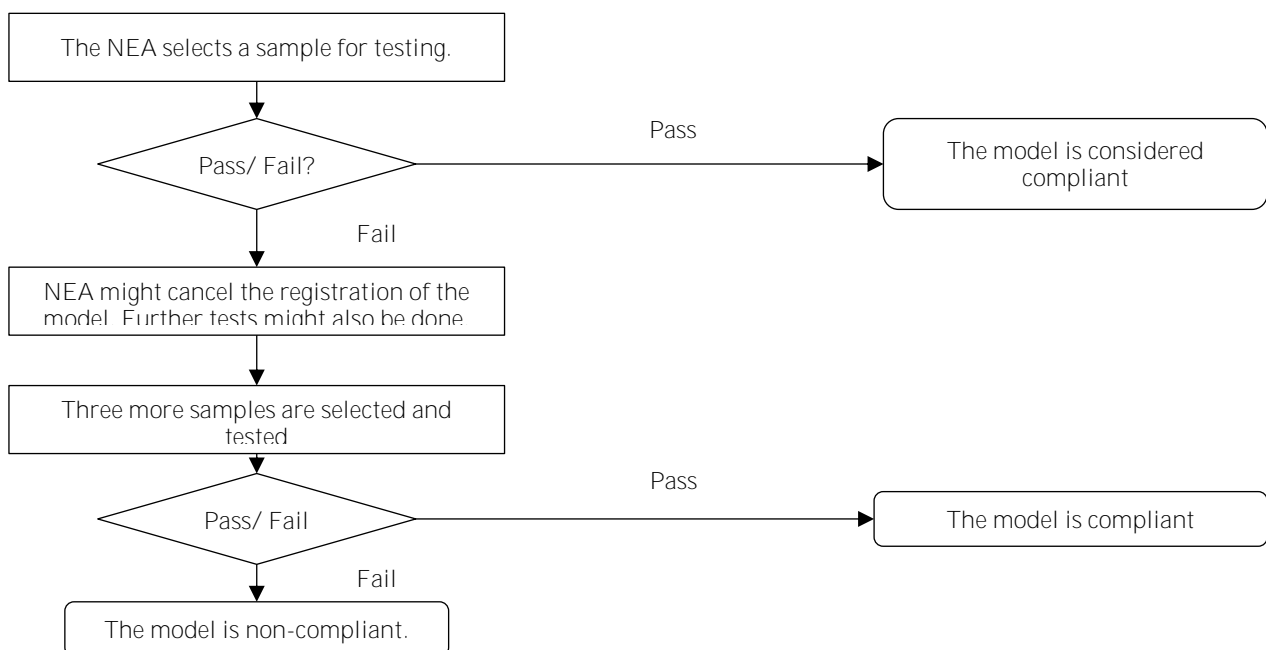
- Promotes energy efficiency and conservation to improve air quality, reduce greenhouse gas emissions and help mitigate climate change.
- The Energy Efficiency Programme Office (E2PO) of the NEA integrates the overall efforts of the public, private and people sectors to improve energy efficiency.

#### Manufacturers

Obligations of dealers are also mentioned in the regulations. They include the following:

- Attaching the label to the product at the point of sale. The label is to be inserted outside of the front or top of the product, in such a way as to be clearly visible.

### MV&E mechanism



<sup>15</sup> Retrieved from: <http://www.energylabel.emsd.gov.hk/en/faq/faqs.html>

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## *China: Minimum Energy Performance Standards*

In 2004, China's National Development and Reform Commission (NDRC) and the Administration of Quality Supervision, Inspection and Quarantine of China (AQSIQ) released the "Measures management of the energy label", which initiated the introduction of a mandatory energy-labelling programme in China. Under the mandatory energy labelling program, a comparative label was designated to the appliances, which used a categorical system from Grade 1 (best) to Grade 5 (worst).

### *Stakeholders*

#### *CNIS*

The role of CNIS is as follows:

- Issuance of registration numbers to various products and their enlistment
- Maintaining a list of registered models
- Routinely selecting samples of listed models for compliance monitoring by independent laboratories
- Overall management of the programme

#### *AQSIQ*

The role of AQSIQ is as follows:

- To draft and revise the state laws and regulations on standardization, to formulate and implement the policies on standardization, to formulate the national administrative rules on standardization and develop relevant systems, and to organize the implementation of laws, rules and systems on standardization.
- To formulate the development programs on standardization of China, to organize, coordinate and draft the programs on the development and revision of national standards, to be responsible for the examination, approval, numbering and publication of national standards.
- To be responsible for coordinating and administering national technical committees of standardization concerned, coordinating and guiding sectoral and local standardization work, and to be responsible for registration of sectoral and local standards.

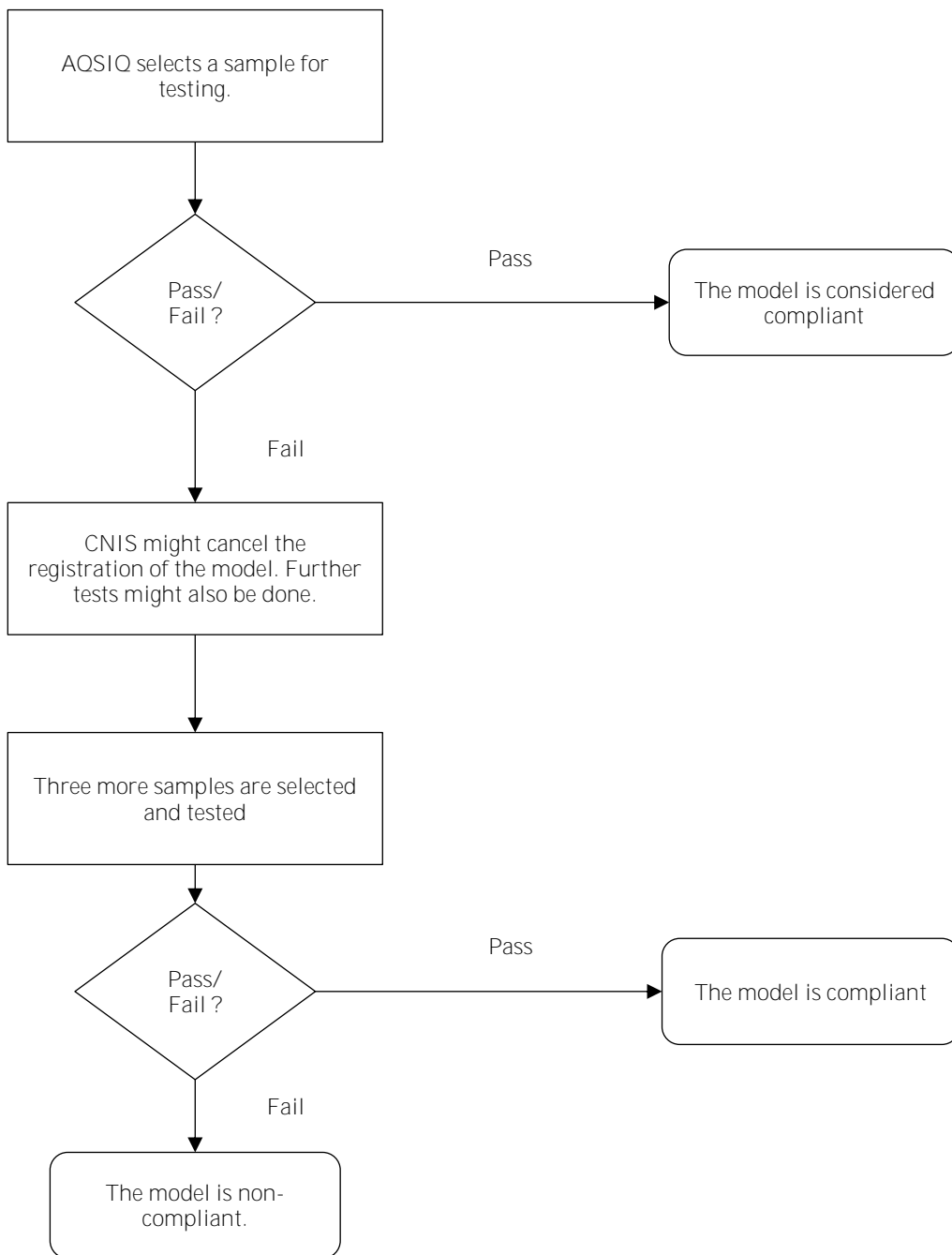
#### *Manufacturers*

- Attaching the label, as provided by suppliers as per the instruction of the AQSIQ, to the product at the point of sale. The label is to be inserted in such a way as to be clearly visible.

### *MV&E mechanism*

The regular product quality testing happens every quarter and the special product quality testing is set according to the degree of concern over product quality.

The China Energy Label Center (CELC) within CNIS supervises the registration and monitors the use of energy information labels.



## Malaysia: Minimum Energy Performance Standards

Malaysia introduced a mandatory comparative labelling program for household appliances in early 2000s. The label uses a star rating approach with 1 star indicating the lowest efficiency and 5 stars the highest efficiency.

### Stakeholders

#### SIRIM

- Promotes energy efficiency and conservation to improve air quality, reduce greenhouse gas emissions and help mitigate climate change.
- The Energy Efficiency Programme Office (E2PO) of the NEA integrates the overall efforts of the public, private and people sectors to improve energy efficiency.

## Suppliers

The roles and obligations of the suppliers are clearly mentioned in the respective regulations for each product. These roles and obligations include the following:

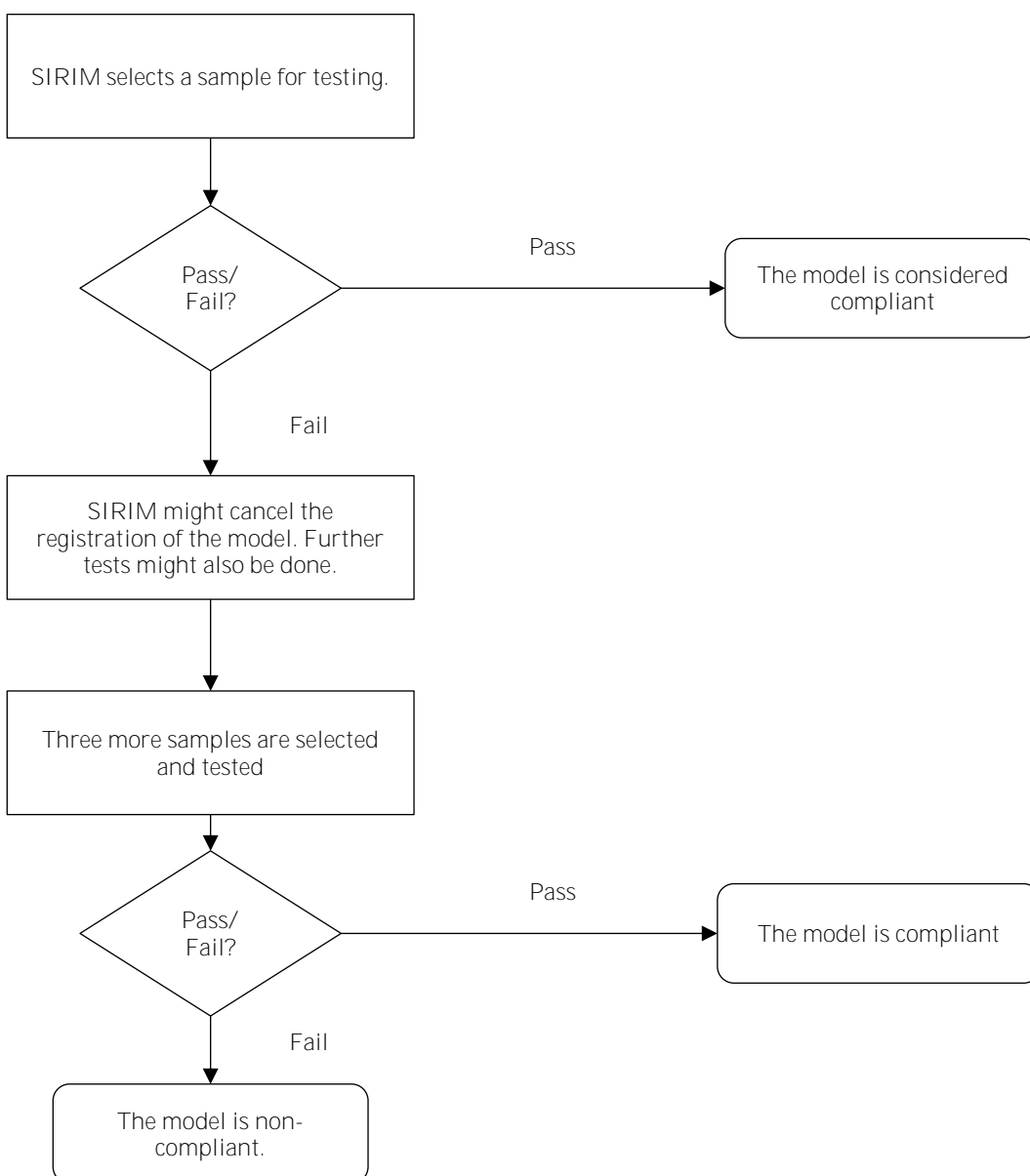
- Supply a label with each product, free of charge, to dealers.
- Make available the technical information on request to SIRIM.

## Dealers

Obligations of dealers are also mentioned in the regulations. They include the following:

- Attaching the label, as provided by suppliers, to the product at the point of sale. The label is to be inserted in such a way as to be clearly visible.

## MV&E mechanism



## Summary of international S&L programmes

A summary of the international S&L programmes with respect to MV&E of the S&L scheme is shown in Table 4 below.

Table 4: Summary of international S&L programmes

Programme	Country	Programme type	Key stakeholders for MV&E	M&V aspects covered	Learnings for programme in Maldives
ENERGY STAR	The US	Voluntary	US EPA, US DOE, CBs conduct inspections independently	Check testing	Several agencies conduct check testing independently. This increases the efficacy of MV&E and reduces chances of fraud.
The Energy Rating Label	Australia	Mandatory for few appliances	GEMS Regulator responsible for MV&E	Check testing	SOPs for MV&E have been defined very clearly for this programme.
The EU Energy Label	European Union	Mandatory for 11 appliances	Member states	Check testing	The EU programme emphasizes the role of dealers and retailers for the promotion of energy labels.
MEELS	Hong Kong	Mandatory	The Director	Check testing	The MEELS programme has a very clearly defined structure. However, the model may not be applicable in the Maldivian context since the authority of conducting testing is solely with the Director.
MELS	Singapore	Mandatory	NEA, manufacturers	Check testing	The MELS programme has an organized structure. Is applicable in the Maldivian context as one specific organization implements the entire MV&E. Dealers are not considered as stakeholders.
MEPS	China	Mandatory	CNIS, AQSIO, Manufacturers	Check testing	The MEPS programme has an organized structure. More than one body, AQSIO and CNIS implement the M&V mechanism.



					Dealers are not considered as stakeholders.
MEPS	Malaysia	Mandatory	SIRIM, Dealers, Suppliers and manufacturers	Check testing	The MEPS programme has an organized structure. The distinction between MV&E programme of Malaysia and other countries such as Singapore and Hong Kong is not clearly visible.

It can be seen from the above table that in the five international S&L programmes under consideration, only check testing is conducted by the respective implementing bodies. Label verification is only conducted with an objective to ensure that those appliances found non-compliant in check testing are not present in the market. Also, each programme has a different provision kept for enforcement, from imposing penalties to prosecution in a court of law.

The programmes discussed above are only relevant to check testing and not to label verification. The information is useful to BEE for strengthening the check testing scheme for the S&L programme in Maldivian.



**Ministry of Environment**

# Development and Implementation of Standards and Labelling Programme in the Maldives

*Impact assessment & enforcement of EE labelling  
program– Task 5*

Strengthening Low Carbon  
Energy Island Strategies (LCEI) Project



# *List of abbreviations*

<b>EE</b>	<b>Energy Efficiency</b>
GHG	Greenhouse gas
CAGR	Compound annual growth rate
EU	European Union
FY	Financial year
kg	Kilogram
kWh	Kilowatt-hours
L	Litres
LCEI	Low Carbon Energy Island
MCS	Maldives Customs Services
MEA	Maldives' Energy Authority
MEPS	Minimum Energy Performance Standard
MWh	Megawatt-hours
PwC	PricewaterhouseCoopers
tCO <sub>2</sub>	Tonnes of CO <sub>2</sub>
TTD	Through-the-door
UNFCCC	United Nations Framework Convention on Climate Change

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# 1. Framework to monitor implementation of the EE labelling scheme

## 1.1. Introduction

Monitoring and evaluation of an EE labelling program is conducted to evaluate whether the program is running smoothly and the objectives of the program are being met. In situations where this is not so, monitoring and evaluations helps identify the lacunas – whether in implementation, program structure or other areas – which can be resolved to ensure that the program meets its intended purpose.

A monitoring framework or an evaluation matrix can be used to objectively measure the success of a project. This report discusses the monitoring framework proposed for the EE labelling program in the Maldives and describes the steps to use such a framework.

The monitoring framework comprises of the logical framework of the program, indicators to assess the success or failure of the program, roles and responsibilities of various stakeholders, and data flow & management considerations.

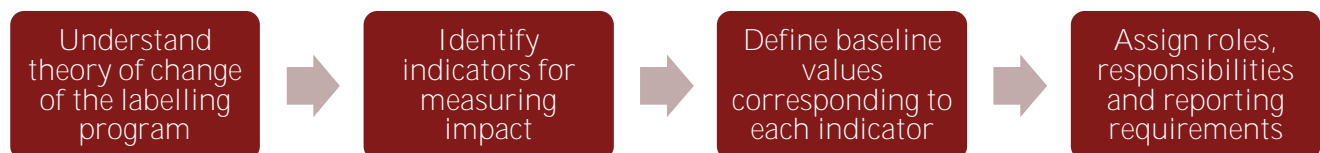
## 1.2. Development of monitoring framework

In general, a monitoring framework for a project is defined on the basis of its proposed theory of change chart. The overall project is first segmented into its various activities, each of which have intended outcomes and these outcomes lead to the main goal/objective of the program.

Then, against each activity, output and goal, indicators are identified to assess whether the activity has met its intended targets. Once the indicators are defined, the corresponding baseline values are determined at the start of the program for each indicator. During the project, the values of the indicators shall be compared with the baselines to measure success/failure of the project.

The final aspect of the monitoring framework is determination of roles, responsibilities and reporting requirements during the project implementation phase. This also includes specifying the frequency of data collection and assessment of indicators during implementation.

In summary, the process for development of monitoring framework is described below:



*Figure 1: Process for development of monitoring framework*

The project team has developed a framework on the basis of the abovementioned process, which is described in the following subsection.

### 1.3. Proposed framework

	PROJECT SUMMARY	INDICATORS	MEANS OF VERIFICATION	RISKS / ASSUMPTIONS
<b>Goal</b>	<ul style="list-style-type: none"> <li>Reduced energy and water consumption</li> <li>GHG emission avoided as a result of reduced energy &amp; water consumption</li> </ul>	<ul style="list-style-type: none"> <li>Net energy savings during the assessment period (MWh)</li> <li>Net water savings during the assessment period (L)</li> <li>GHG emission avoided during the assessment period (tCO2)</li> </ul>	N/A	Net energy, water savings are attributable to the EE labelling program
<b>Outcomes</b>	<ul style="list-style-type: none"> <li>Increased sales of appliances with higher efficiency</li> <li>Enhanced interest of financing institutions and banks in financing efficient appliances</li> </ul>	<ul style="list-style-type: none"> <li>Sale/import of appliances with higher efficiencies</li> <li>Availability of financing products for energy efficient appliances</li> </ul>	<ul style="list-style-type: none"> <li>Data on appliance efficiencies/star ratings, sales in MEA database</li> <li>Data of imports from Maldives Customs Services (MCS)</li> <li>Data from banks</li> </ul>	N/A
<b>Outputs</b>	<ul style="list-style-type: none"> <li>Increased awareness on energy efficiency of appliances</li> <li>Increased demand for energy efficient appliances</li> <li>Increased demand for consumer finance for efficient appliances</li> </ul>	<ul style="list-style-type: none"> <li>Influence of label on <b>consumer's purchasing</b> pattern</li> <li>Need of consumers to finance the energy efficient products which may come at a premium price</li> </ul>	<ul style="list-style-type: none"> <li>Periodic consumer surveys</li> <li>Periodic retailer surveys</li> </ul>	<ul style="list-style-type: none"> <li>Consumers are informed of the monetary savings related to use of efficient appliances and are ready to pay a premium for efficient appliances</li> <li>Appliances with higher efficiencies are available in the market</li> </ul>
<b>Activities</b>	Smooth functioning of the EE labelling program	Percentage of imported appliances affixed with a label	<ul style="list-style-type: none"> <li>Data from Maldives Customs Services (MCS)</li> <li>Periodic market surveillance</li> </ul>	N/A

## 1.4. Description of indicators

The indicators are used to determine the net energy savings after the implementation of the EE programme. There are two types of indicators: direct and indirect.

### Direct indicators

Direct indicators can be used to analyze the impact of implementation of the EE programme with the help of the data recorded over a period of assessment. The direct correlation between the assessed data and increase/decrease in the net efficiency of the market for a particular appliance makes these indicators direct indicators.

For e.g. the calculation of net energy-savings can directly show whether the implementation of the EE programme has been effective or not. If the net energy savings for the assessment period comes out to be positive, it means that the implementation of the programme is effective. If not, then the implemented programme is deemed non-effective.

### Indirect indicators

The indirect indicators are those, which cannot directly indicate the efficiency of the implementation of the EE programme.

The indirect indicators are not able to prove the efficiency of a programme mathematically, but they give an idea about the quality programme by setting a trend through graphs and survey, which can be extrapolated to identify the impact of implementation of a particular programme for a particular period of assessment.

For e.g. if no. of appliances in the market with energy labels of higher energy level increase over the period of assessment, it means that there has been an effective implementation of the EE labelling programme.

### 1.4.1. Indicator 1 – Overall energy savings & GHG emission reduction attributable to the EE labelling program (Direct Indicator)

The net energy savings accrued up to the evaluation date from the EE programme is the sum of individual energy savings from each appliance – air conditioners, refrigerators and washing machines.

This value shall be calculated to assess whether the EE labelling programme implementation assists in increased energy efficiency or not. Using the net energy savings, the change in GHG emission shall be observed as well.

Indicator	Description
<b>Definition</b>	Total energy savings (kWh) and corresponding GHG emission (tCO <sub>2</sub> ) reduction during the assessment period <i>The savings are calculated against an assumed baseline and are calculated individually for each appliance. The overall procedure is explained in following chapters.</i>
<b>Purpose</b>	To understand the net impact of implementing the EE labelling program in the Maldives
<b>Baseline</b>	Defined separately for separate appliances. Usually it is: <ul style="list-style-type: none"><li>• Either the upper limit energy consumption of the lowest EE level (<b>this has been considered for assessment of savings in this report</b>), or</li></ul>



	<ul style="list-style-type: none"> <li>• 10% more than the upper limit energy consumption of the lowest EE level.</li> </ul>
<b>Target</b>	N/A
<b>Data Collection</b>	<p>Data required includes the technical energy performance details as well as the sales/import nos. of each model of the appliances.</p> <p>Hence, the data available with both MEA and MCS will be useful for the assessment.</p> <p>The MEA shall consider the energy performance details of each appliance as recorded in the application database during the application processing for the relevant model.</p> <p>Maldives Customs Services (MCS) has the mandate to regulate the imports of goods in the country. MCS shall keep a record of the overall imports along with their star ratings of all models of appliances under the purview of the labelling regulation. In addition, during the voluntary stage of the program, MCS shall also keep a record of imports of all unlabeled appliances.</p> <p>This information shall be shared with MEA on a regular basis.</p>
<b>Tool</b>	Created separately for all the appliances assessed (information captured in subsequent chapters of this report)
<b>Frequency</b>	It can be done half yearly and /or annually
<b>Responsible</b>	<p>MEA for conducting the overall assessment</p> <p>MCS for collection of data and supporting MEA in the assessment</p>
<b>Reporting</b>	The assessment shall be conducted half yearly and/or annually to understand the impact of the labelling scheme. The information shall be presented to the competent authority annually.
<b>Quality Control</b>	MEA officials shall evaluate the overall methodology and assumptions taken for the assessment to reflect the on-ground situation of labelled appliances in the Maldives.

### ***1.4.2. Indicator 2 - Percentage of imported appliances present with a label (Indirect Indicator)***

A questionnaire shall be created to seek the responses from relevant stakeholders and observe the change in percentage of imported appliances present with a label to assess whether the stakeholders are promoting the import of energy efficient appliances into the Maldives.

<b>Indicator</b>	<b>Description</b>
<b>Definition</b>	<p>Total number of appliances imported affixed with an EE label divided by Total number of appliances imported</p> <p><i>This figure is calculated separately for the financial year for each appliance under the purview of the labelling scheme</i></p>

<b>Purpose</b>	To assess the extent of participation in the EE labelling program for a given financial year
<b>Baseline</b>	0
<b>Target</b>	100%
<b>Data Collection</b>	Maldives Customs Services (MCS) conducts checks during imports to ensure that the imported appliances are affixed with a label. The details of the labeled appliances will be recorded in customs database and shared with Maldives Energy Agency (MEA) on a regular basis.
<b>Tool</b>	A form is created for the same.
<b>Frequency</b>	Annually
<b>Responsible</b>	Maldives Customs Services (MCS) for collection of data Maldives Energy Authority (MEA) for annual assessment
<b>Reporting</b>	To be filled by the MCS at the time of clearance. This data shall be combined annually and submitted to the MEA at the end of the financial year. This exercise is to be repeated monthly.
<b>Quality Control</b>	Capacity building and training session shall be held for officials from MCS and MEA to apprise them about the data collection process and the need for the same. In addition, an official from MEA shall visit MCS frequently to ensure that the data collection process is conducted as per expectations.

### ***1.4.3. Indicator 3 - Influence of label on consumer's purchasing pattern (Indirect Indicator)***

A questionnaire shall be created to seek responses from relevant stakeholders and observe the change in energy efficiency perception of customers for purchasing and promoting energy efficient appliances into the Maldives.

<b>Indicator</b>	<b>Description</b>
<b>Definition</b>	Total no. of consumers aware of the energy labelling program and divided by the total no. of consumers surveyed in the questionnaire.
<b>Purpose</b>	<b>To assess the overall impact of the EE label on the consumers' criteria</b> while purchasing labelled appliances
<b>Baseline</b>	As per LCEI consumer study, 39% consumers are aware about the term energy efficiency at the beginning of the programme. This baseline may be updated at five years interval, or as suitably decided by ME.
<b>Target</b>	75%
<b>Data Collection</b>	A questionnaire is created to collect the data from the same
<b>Tool</b>	A form is created for the same.

<b>Frequency</b>	Annually
<b>Responsible</b>	Maldives Energy Authority (MEA) for annual assessment
<b>Reporting</b>	<p>The survey questionnaire shall be assessed annually to probe the overall influence on the consumer.</p> <p>The questionnaire shall be filled by the importers on a monthly basis with the help of the consumer data. This data shall be combined annually and submitted to the MEA at the end of the financial year.</p>
<b>Quality Control</b>	<p>Capacity building and training shall be held for the relevant stakeholders.</p> <p>MEA shall assess the distribution of sales/imports among the five EE bands of the label to verify whether the actual sales figures are in line with <b>the survey's</b> findings. This exercise shall be conducted annually for the first 3 years of the program and bi-annually thereafter.</p>

#### ***1.4.4. Indicator 4 - Sale/ import of appliances with higher efficiencies (Indirect Indicator)***

<b>Indicator</b>	<b>Description</b>
<b>Definition</b>	Distribution of overall import of appliances into the five EE classes defined in the label
<b>Purpose</b>	To understand the relative penetration of energy efficient appliances in the Maldivian market after the introduction of the EE labelling program
<b>Baseline</b>	N/A
<b>Target</b>	N/A
<b>Data Collection</b>	<p>Maldives Customs Services (MCS) has the mandate to regulate the imports of goods in the country. MCS shall keep a record of the overall imports along with their star ratings of all models of appliances under the purview of the labelling regulation. In addition, during the voluntary stage of the program, MCS shall also keep a record of imports of all unlabeled appliances.</p> <p>This information shall be shared with MEA on a regular basis. A template for data collection is provided.</p>
<b>Tool</b>	Market inspection shall be done for the same.
<b>Frequency</b>	Annual
<b>Responsible</b>	<p>MEA for conducting the assessment</p> <p>MCS for supporting by providing relevant data</p>

<b>Reporting</b>	<p>The questionnaire shall be filled by the importers on a monthly basis. This data shall be verified with the MCS. The MCS shall then send the consolidated data for an entire financial year to the MEA.</p> <p>This information shall be presented to the LCEI program manager on an annual basis.</p>
<b>Quality Control</b>	<p>MEA will collaborate with major retailers/ importers to verify the data provided by MCS and ensure that the insights drawn reflect the on-ground situation in the Maldives.</p>

## 1.5. Data collection protocols

The indicators mentioned in the previous section are to be calculated periodically to adequately evaluate the success of the labelling programme. As such, calculation of each indicator requires detailed amount of data, which needs to be processed by MEA.

The following table lists the indicators, identifies the data required to calculate each indicator's value and pinpoints the potential sources of collection of data.

*Table 1: Potential sources of data collection*

<b>S. No.</b>	<b>Indicator</b>	<b>Calculation</b>	<b>Data required</b>	<b>Potential sources</b>
<b>1</b>	Overall energy savings & GHG emission reduction attributable to the EE labelling program	Total energy savings (kWh) and corresponding GHG emission (tCO <sub>2</sub> ) reduction during the assessment period	<ul style="list-style-type: none"> <li>Annual model-wise import numbers,</li> <li>Model wise energy/water consumption values</li> <li>Model wise capacity values</li> <li>Grid emission factor for Maldives</li> </ul>	<ul style="list-style-type: none"> <li>Technical information about the appliances such as each model specific energy details from the database with MEA (created during application stage)</li> <li>MCS is the primary custodian of import/export data</li> <li>The grid emission factor is available under UNFCCC reports</li> </ul>
<b>2</b>	Percentage of imported appliances present with a label	Total number of appliances <sup>1</sup> imported affixed with an EE label divided by Total number of appliances imported	<ul style="list-style-type: none"> <li>Total number of appliances imported per year</li> <li>Total number of appliances which are affixed with a label</li> </ul> <p><i>These numbers are calculated separately for each appliance</i></p>	MCS is the primary custodian of import/export data

<sup>1</sup> Appliances refer to those appliances which are covered under the EE labelling program

<b>S. No.</b>	<b>Indicator</b>	<b>Calculation</b>	<b>Data required</b>	<b>Potential sources</b>
<b>3</b>	Influence of label on consumers' purchasing pattern	Total no. of consumers buying a specific appliance of level 3 and above divided by the total no. of consumers buying that appliance in a particular year.	<ul style="list-style-type: none"> <li>• Import of appliances which have an energy rating 3 and above, collected from MCS.</li> <li>• Total import of appliances</li> </ul> <p><i>These numbers are calculated separately for each appliance</i></p>	MCS is the primary custodian of import/export data Also, the importers shall be able to provide this information to MEA as per the directions from MEA
<b>4</b>	Sale/import of appliances with higher efficiencies	Distribution of overall import of appliances into the five EE classes defined in the label	Distribution of overall import of appliances into the five EE classes defined in the label <i>These numbers are calculated separately for each appliance</i>	MCS is the primary custodian of import/export data Also, the importers shall be able to provide this information to MEA as per the directions from MEA

As shown in the above table, all the data required for assessment of the labelling program is directly available with MCS. In fact, MCS is the primary custodian of the data required. Therefore, for effective monitoring of impacts of the EE labelling program, MEA must retrieve the required data from the MCS on a timely basis.

## ***1.6. Proposed data sharing arrangement between MEA & MCS***

Under Task 3 of the scope of work, the PwC team was tasked with development and design of an implementation procedure for the EE labelling program. A key component of the implementation procedure was coordination and information sharing between MEA and MCS. A snapshot of the procedure is shown below.

### 3.4. Coordination between the MEA and the MCS

Within the existing procedure of the customs, the import of labelled appliances shall take place as per the steps described in the procedure.

The information about the approved appliances shall be given from the MEA to the MCS. This shall be done for every approved product model, in the form of an online excel sheet that can be updated every day.

Sl. No.	Applicati on No.	Applica nt Name	Type of appliance	Brand	Model	Informati on on family of model	Capacit y (kg)	Type	Electricity consumption kWh/cycle/kg	Water consumpti on L/cycle/kg	Cleaning performance	Result
1	A1	Applica nt 1	Washing Machine	B1	B1M1	Series M	0.000	Front Load (Drum Type)	0.186	11.31	1.12	Level 1
2	A2	Applica nt 2	Washing Machine	B2	B2M1	Series M	0.000	Top Load (Impeller Type)	0.029	14.41	0.95	Disqualified

### 3.5. Coordination between the MCS and the importer

Coordination between the MEA and the importer is required so that the importer submits the information about the product models to be imported, along with the label grade allotted to the product by the MEA.

This information shall be used by the MCS to verify the label grade allotted to the appliance by the MEA and the importer, thereby giving the product a clearance to be imported into the Maldives.

The template of the record shall be same as that of the template in which the MEA conveys the product information to the MCS.

Figure 2: Coordination mechanism proposed in the implementation procedure

The below table shows the data to be provided by MCS to MEA for identifying the requirements of appliances details covered under the energy efficiency labelling program.

Table 2: Data to be provided by MCS to MEA

Sr. No	Appliances	HSN Code
1	Import of labelled Fixed speed Air Conditioners	8415100000
2	Import of labelled Variable speed Air Conditioners	8415100000
3	Import of labelled Refrigerator-Freezers combination	8418100000
4	Import of labelled Refrigerator only appliance	8418210000
5	Import of labelled Front load Washing Machine	8450120000
6	Import of labelled Top load Washing Machine	8450120000

In the above arrangement, MCS shall have the detailed information on the model-wise import of the appliances covered under the labelling program. As proposed under the implementation report, MCS shall share this information with MEA, who shall maintain a database (repository) for model-wise imports.

Therefore, as such, **a separate data collection protocol for this activity is not necessary, as long as the database of MEA as explained in the implementation framework is adequately maintained.**

The project team will separately share excel based tools to support the calculation of the above indicators. A snapshot of the tools are provided in the annexure of this document.

# Indicator 1: Estimation of net energy savings and GHG emission reductions

The main objective of implementing the EE labelling program in the Maldives is to drive reductions in the net energy consumption from energy intensive appliances and consequently avoid GHG emissions. This chapter provides guidelines on estimating this impact for each appliance covered under the mandate of the labelling program. **It is expected that this evaluation shall be conducted annually by officials from MEA.**

The net energy savings accrued up to the evaluation date from the EE program is the sum of individual energy savings from each appliance – air conditioners, refrigerators and washing machines. This is shown in the following table:

*Table 3: Calculation of net energy savings & GHG emission reduction*

S. No.	Factor	Unit	Calculation
1	Net energy savings from air conditioners	MWh	shown below
2	Net energy savings from refrigerators	MWh	shown below
3	Net energy savings from washing machines	MWh	shown below
4	<b>Net energy savings</b>	<b>MWh</b>	<b>1+2+3</b>
5	Grid emission factor for the Maldives	tCO <sub>2</sub> /MWh	
6	<b>Net GHG emission reduction</b>	<b>tCO<sub>2</sub></b>	<b>4*5</b>

An important aspect of the above calculation is the assessment period. Since the energy savings is a comparative indicator, estimation of the baseline and impact of the EE labelling program on the baseline must be estimated separately during the assessment period. For this analysis, **we have assumed that the assessment period begins from the first full financial year for which the EE labelling program is implemented.**

In addition, it is advisable that net energy savings for each appliance type is conducted separately and the result is then aggregated to facilitate the evaluation process. The process for calculation of net energy savings for each appliance is described in the following sections.

## 1.7. Procedure for estimation of net energy savings for air conditioners

This section describes the procedure for estimation of net energy savings from air conditioners. **The total energy savings is the sum of annual energy savings attributable to air conditioners sold during each year of the assessment period.**

The net energy savings for air conditioners for a specific period of assessment shall be calculated based upon certain parameters. An excel tool is designed for the purpose of evaluating the data required to do the calculations. The parameters shall be given as an input to the tool, which in turn will use the assumptions and estimate the net energy savings.

The following assumptions are made during the calculation of energy savings attributable to the air conditioner labelling program for simplification:

### Assumptions

- All air conditioners imported during a financial year are assumed to be sold in the same financial year. Therefore, total sales during the current financial year equals the total imports in the financial year.
- The outside temperature and other conditions are same as those under standard test conditions.

**The total energy savings is the sum of annual energy savings attributable to air conditioners sold during each year of the assessment period.** For each year in the assessment period, annual savings attributable to an air conditioner sold during each year is calculated as the product of the following factors:

Table 4: Calculation of annual energy savings for air conditioners

Factor	Unit	Description
$\Delta$ (average power consumption)	KW	Difference in actual power consumption values between <b>baseline and actual values</b> for the year
Annual hours of usage	hours	Average no. of hours of operation per year
Sales	millions	Sale of air conditioners during the financial year
No. of years of operation	years	Air conditioners sold offer energy savings during entire period of operation in the assessment period

This calculation is done separately for fixed speed air conditioners and inverter air conditioners since there is significant difference in per-cycle energy consumption values among these machines.

### 1.7.1. Estimation of annual air conditioner sales

The annual air conditioner sales for the current financial year is assumed to be equal to the total import figure for the same financial year for the purposes of the calculation.



## 1.7.2. Calculation of $\Delta$ (average power consumption)

“ $\Delta$ (power consumption)” refers to the difference between the baseline sales-weighted average power consumption and the actual power consumption of air conditioners for the year.

This calculation consists of two aspects – 1) Average power consumption in the baseline scenario for the financial year, and 2) Sales-weighted average power consumption for the given financial year.

### Calculation of baseline power consumption

The baseline scenario describes the market situation during the assessment period in a scenario had the labelling program not been implemented.

Therefore, in the baseline situation, we assume that the EE labelling program would not have been implemented. Consequently, there would be no push in the market to move towards efficient appliances. This implies that **the average power consumption for an air conditioner category would have remained constant over the entire baseline scenario.**

**Therefore, the baseline scenario power consumption is the same as the sales-weighted power consumption in the year before the program was first launched, i.e. in FY 2019.**

$$\text{Baseline power consumption} = \frac{\text{Average cooling capacity}}{\text{Cooling Seasonal Performance Factor (CSPF)}}$$

**Given the unavailability of information on the existing market scenario, we have assumed that in the baseline scenario, the power consumption (P) of an air conditioner is equal to the minimum allowable COP value corresponding to the lowest EE level.**

### Calculation of the actual power consumption for the year

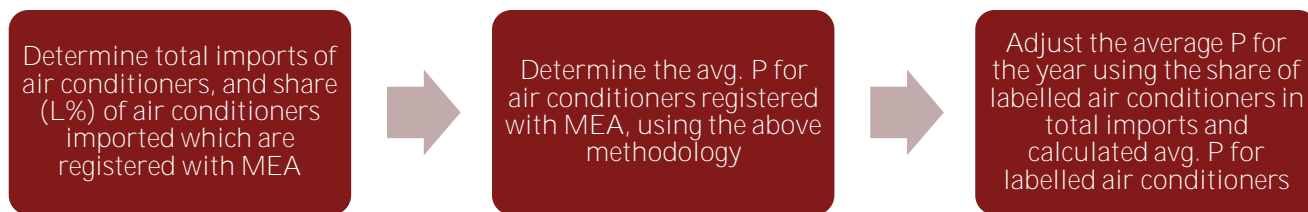
Calculation of the power consumption is more straightforward than estimating the baseline value for the year. The actual power consumption for the year is the **sales-weighted power consumption value for the year.** Like in the baseline situation, this is calculated separately for each air conditioner type and each year during the assessment period. A sample template for calculation for a particular air conditioner type is shown below.

Table 5: Illustrative calculation of actual per-cycle energy savings for a particular air conditioner type

EE band	Avg. power consumption	Sales for year 1	Sales for year 2
Level 5	A1	B1	C1
Level 4	A2	B2	C2
Level 3	A3	B3	C3
Level 2	A4	B4	C4
Level 1	A5	B5	C5
unlabeled	A6	B6	C6
<b>Sales-weighted avg. power consumption value</b>		$=(A1*B1+A2*B2+...+A6*B6)/(B1+B2+...+B6)$	$=(A1*C1+A2*C2+...+A6*C6)/(C1+C2+...+C6)$

The above calculation is valid, however, only for years where the labelling program has been made mandatory for air conditioners. In this case, data on power consumption will be available with MEA for all models sold in the market.

However, in the voluntary stage of the labelling program, labelling of air conditioners will be voluntary and therefore MEA will have P and import numbers only for models registered for the labelling scheme. In this case, the following approach is adopted for calculating the actual average power consumption. **It is assumed that the P of models not registered with MEA is equal to the baseline value.**



The adjustment of the average P for the year is done using the following formula:

$$\text{Adjusted average } P = L\% \times \text{Avg. } P + (1 - L\%) \times P_{\text{baseline}}$$

### 1.7.3. Other assumptions

The other factors to be assumed are shown below:

Factor	Unit	Description
Annual hours of operation	hours	Average no. of hours an air conditioner is run in a year
No. of years of operation	years	Air conditioners sold offer energy savings during entire period of operation in the assessment period

The number of years of operation is important to calculate the net energy savings attributable to the air conditioner sold during a particular year. For example, an air conditioner sold in year 2 will continue to operate in year 4, providing a savings equivalent to 3 years.

**The no. of years of operation for a given year is the no. of years of operation during the assessment period or the life of the air conditioner, whichever is less.**

**These values are fed into the calculation template and the final calculation is performed.**

### 1.7.4. Final results

The overall energy savings are automatically calculated in the template once the above values are fed in and are indicated in the “RESULT” worksheet, as shown below:

Table 6: Illustrative result worksheet

Fixed speed air conditioner	million kWh	
Variable speed air conditioner	million kWh	
<b>Total energy savings</b>	<b>million kWh</b>	
	<b>MWh</b>	

## ***1.8. Procedure for estimation of net energy savings for refrigerators***

This section describes the procedure for estimation of net energy savings from refrigerators. **The total energy savings is the sum of annual energy savings attributable to refrigerators sold during each year of the assessment period.**

The net energy savings for refrigerators for a specific period of assessment shall be calculated based upon certain parameters. An excel tool is designed for the purpose of evaluating the data required to do the calculations. The parameters shall be given as an input to the tool, which in turn will use the assumptions and estimate the net energy savings.

### ***1.8.1. Parameters required***

The following parameters shall be taken into account for calculating the net energy savings:

1. Category of refrigerator: there are 4 categories of refrigerator, as per the Maldivian standards, namely:
  - Refrigerator without freezer
  - Refrigerators with freezer and adjusted volume  $\leq 300l$
  - Refrigerators with freezer and  $300l < \text{adjusted volume} \leq 900l$
  - Refrigerators with freezer and TTD (Through the door) dispenser

These different categories will be considered while estimating the net energy savings.

2. Label grade: The label grade refers to the EE levels as per the Maldivian standards. There are 4 levels of energy efficiency, from Level 2 (least efficient) to Level 5 (most efficient).
3. Average refrigeration cabinet volume: This refers to the average volume of the refrigeration cabinet for a refrigerator belonging to a particular category.
4. Average freezer cabinet volume: This refers to the average volume of the freezer cabinet for a refrigerator belonging to a particular category.
5. Average freezer star rating: Average freezer star rating refers to the rating given to the freezer as per the temperature range of the freezer.
6. Period of assessment: Period of assessment is defined as the period for which the assessment is done.

### ***1.8.2. Assumptions***

The following parameters must be assumed to estimate the net energy savings during the assessment period:

1. The period of assessment is taken to be 10 years, from FY 2019 to FY 2030.
2. The average life of a refrigerator is assumed to be 15 years.
3. There are only four categories of refrigerators in the Maldives for the entire period of assessment. These categories are:
  - Refrigerator without freezer
  - Refrigerators with freezer and adjusted volume  $\leq 300l$
  - Refrigerators with freezer and  $300l < \text{adjusted volume} \leq 900l$
  - Refrigerators with freezer and TTD (Through the door) dispenser

### ***1.8.3. Approach for calculation of net energy savings***

For each year in the assessment period, annual energy savings attributable to refrigerators sold during each year is calculated as the product of the following factors. This calculation is done separately for each category of refrigerators.

Table 7: Calculation of annual energy savings from refrigerators

Factor	Unit	Description
<b>Δ(average annual energy consumption)</b>	kWh	Difference in annual energy consumptions between <b>baseline and actual values</b> for the year
<b>Sales</b>	millions	Sale of refrigerators during the financial year
<b>No. of years of operation</b>	years	Refrigerators sold offer energy savings during entire period of operation in the assessment period

### 1.8.4. Estimation of annual refrigerator sales

The annual refrigerators sales for the current financial year is assumed to be equal to the total import figure for the same financial year for the purposes of the calculation.

These values are fed into the calculation template as shown below:

Table 8: Calculation template (refrigerators)

Category No.	Estimated Sales (Category wise)	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
1	Ref without freezer												
2	Ref with freezer, adjusted vol<300l												
3	Ref with freezer, 300l<adj vol<=900l												
4	Ref with freezer and TTD dispenser												

### 1.8.5. Calculation of Δ(average annual energy consumption)

**“Δ(annual energy consumption)” refers to the difference between the baseline sales-weighted average annual energy consumption and the actual annual energy consumption of refrigerators for the year.**

This calculation consists of two aspects – 1) Average annual energy consumption in the baseline scenario for the financial year, and 2) Sales-weighted average annual energy consumption for the given financial year.

#### Calculation of baseline annual energy consumption

**The baseline scenario describes the market situation during the assessment period in a scenario had the labelling program not been implemented.**

Therefore, in the baseline situation, we assume that the EE labelling program would not have been implemented. Consequently, there would be no push in the market to move towards efficient appliances. This implies that **the average annual energy consumption for a refrigerator category would have remained constant over the entire baseline scenario.**

**Given the unavailability of information on the existing market scenario, we have assumed that in the baseline scenario, the annual energy consumption (AEC) of a refrigerator is equal to the**

**maximum allowable AEC value corresponding to the lowest EE level corresponding to its adjusted volume.**

The adjusted volume for the four refrigerator categories is assumed to be as shown below:

<b>Ref without freezer</b>	120	L
<b>Ref with freezer, adjusted vol&lt;+300l</b>	292.75	L
<b>Ref with freezer, 300l&lt;adj vol&lt;=900l (including TTD)</b>	494.8	L
<b>Ref with freezer and TTD dispenser</b>	742.2	L

### **Calculation of the actual annual energy consumption for the year**

Calculation of the annual energy consumption is more straightforward than estimating the baseline value for the year. The actual annual energy consumption for the year is the **sales-weighted annual energy consumption value for the year**. Like in the baseline situation, this is calculated separately for each refrigerator type and each year during the assessment period.

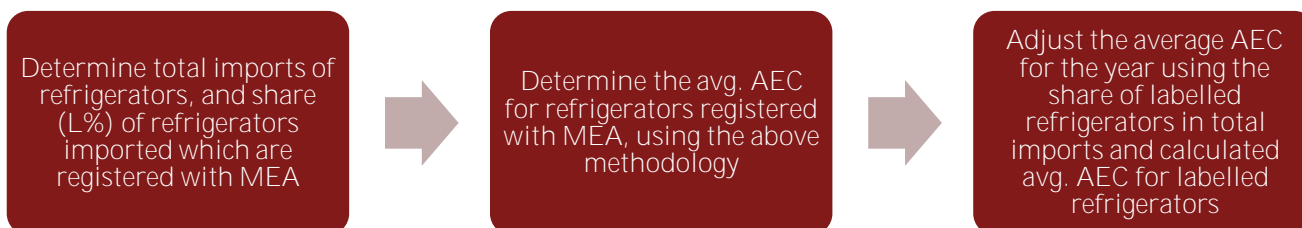
A sample template for calculation for a particular refrigerator type is shown below:

*Table 9: Illustrative template for calculation for a particular refrigerator type*

<b>EE band</b>	<b>Avg. annual energy consumption</b>	<b>Sales for year 1</b>	<b>Sales for year 2</b>
<b>Level 5</b>	A1	B1	C1
<b>Level 4</b>	A2	B2	C2
<b>Level 3</b>	A3	B3	C3
<b>Level 2</b>	A4	B4	C4
<b>Level 1</b>	A5	B5	C5
<b>unlabeled</b>	A6	B6	C6
<b>Sales-weighted avg. per-cycle energy consumption value</b>	$=(A1 * B1 + A2 * B2 + \dots + A6 * B6) / (B1 + B2 + \dots + B6)$	$=(A1 * C1 + A2 * C2 + \dots + A6 * C6) / (C1 + C2 + \dots + C6)$	

The above calculation is valid, however, only for years where the labelling program has been made mandatory for refrigerators. In this case, data on annual energy consumption will be available with MEA for all models sold in the market.

However, in the voluntary stage of the labelling program, labelling of refrigerators will be voluntary and therefore MEA will have AEC and import numbers only for models registered for the labelling scheme. In this case, the following approach is adopted for calculating the actual average energy consumption. **It is assumed that the AEC of models not registered with MEA is equal to the baseline value.**



The adjustment of the average AEC for the year is done using the following formula:

$$Adjusted\ average\ AEC = L\% \times Avg.\ AEC + (1 - L\%) \times AEC_{baseline}$$

### 1.8.6. Other assumptions

The other factors to be assumed are shown below:

Factor	Unit	Description
No. of years of operation	years	Refrigerators sold offer energy savings during entire period of operation in the assessment period

The number of years of operation is important to calculate the net energy savings attributable to the refrigerators sold during a particular year. For example, a refrigerator sold in year 2 will continue to operate in year 4, providing a savings equivalent to 3 years.

**The no. of years of operation for a given year is the no. of years of operation during the assessment period or the life of the refrigerator, whichever is less. These values are fed into the calculation template and the final calculation is performed.**

### 1.8.7. Final results

The overall energy savings are automatically calculated in the template once the above values are fed in and are indicated in the “RESULT” worksheet.

## 1.9. Procedure for estimation of net energy savings for washing machines

This section describes the procedure for estimation of net energy savings from washing machines. Although this is in line with the procedures described for air conditioners and refrigerators, there are several assumptions made pertaining specifically to washing machines:

**Assumptions**

- All washing machine imported during a financial year are assumed to be sold in the same financial year. Therefore, total sales during the current financial year equals the total imports in the financial year.
- The wash/rinse programme used for semi-automatic machines and top loaders is the standard cotton 30° C programme.
- The wash/rinse programme used for front loaders is the standard cotton 60° C programme. That for semi-automatic and top-loaders is the standard cotton 30° C programme.

**The total energy savings is the sum of annual energy savings attributable to washing machines sold during each year of the assessment period.** For each year in the assessment period, annual savings attributable to washing machine sold during each year is calculated as the product of the following factors:

Table 10: Calculation of annual energy savings for washing machines

Factor	Unit	Description
$\Delta$ (average per-cycle energy consumption)	kWh/cycle/kg	Difference in per-cycle energy consumptions between baseline and actual values for the year

<b>No. of cycles per year</b>	-	Average no. of cycles run on a washing machine during the year
<b>average capacity</b>	kg	<b>Sales-weighted</b> average capacity of washing machines sold during the year
<b>Sales</b>	millions	Sale of washing machine during the financial year
<b>No. of years of operation</b>	years	Washing machines sold offer energy savings during entire period of operation in the assessment period

This calculation is done separately for semi-automatic washing machines, top loaders and front loaders since there is significant difference in per-cycle energy consumption values among these machines.

### 1.9.1. Estimation of annual washing machine sales

The annual washing machine sales for the current financial year is assumed to be equal to the total import figure for the same financial year for the purposes of the calculation.

### 1.9.2. Calculation of $\Delta$ (per-cycle energy consumption)

**“ $\Delta$ (per-cycle energy consumption)” refers to the difference between the baseline sales-weighted average energy consumption and the actual energy consumption of washing machines for the year.**

This calculation consists of two aspects – 1) Average per-cycle energy consumption in the baseline scenario for the financial year, and 2) Sales-weighted average per-cycle energy consumption for the given financial year.

#### Calculation of baseline per-cycle energy consumption

**The baseline scenario describes the market situation during the assessment period in a scenario had the labelling program not been implemented.**

Therefore, in the baseline situation, we assume that the EE labelling program would not have been implemented. Consequently, there would be no push in the market to move towards efficient appliances. This implies that **the average per-cycle energy consumption for a washing machine category would have remained constant over the entire baseline scenario.**

**Given the unavailability of information on the existing market scenario, we have assumed that in the baseline scenario, the per cycle energy consumption of a washing machine is equal to the maximum allowable value corresponding to the lowest EE level.**

#### Calculation of the actual per-cycle energy consumption for the year

Calculation of the per-cycle energy consumption is more straightforward than estimating the baseline value for the year. The actual per-cycle energy consumption for the year is the **sales-weighted per-cycle energy consumption value for the year**. Like in the baseline situation, this is calculated separately for each washing machine type and each year during the assessment period. A sample template for calculation for a particular washing machine type is shown below.

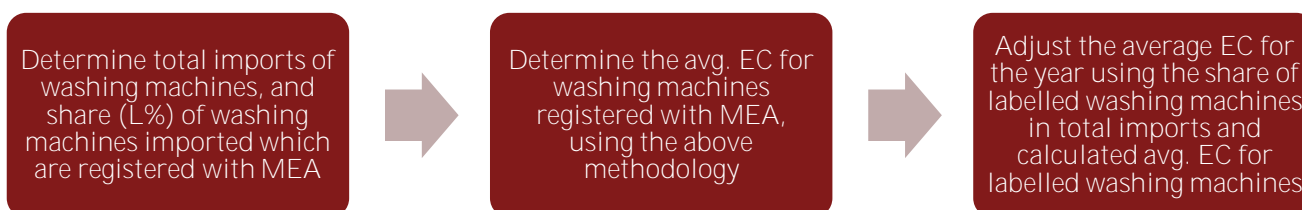
*Table 11: Illustrative calculation of actual per-cycle energy savings for a particular washing machine type*

EE band	Avg. per cycle energy consumption	Sales for year 1	Sales for year 2
Level 5	A1	B1	

EE band	Avg. per cycle energy consumption	Sales for year 1	Sales for year 2
Level 4	A2	B2	
Level 3	A3	B3	
Level 2	A4	B4	
Level 1	A5	B5	
unlabeled	A6	B6	
<b>Sales-weighted avg. per-cycle energy consumption value</b>		$= (A1 * B1 + A2 * B2 + \dots + A6 * B6) / (B1 + B2 + \dots + B6)$	$= (A1 * C1 + A2 * C2 + \dots + A6 * C6) / (C1 + C2 + \dots + C6)$

As in the case for air conditioners and refrigerators, the above calculation is valid, however, only for years where the labelling program has been made mandatory. In this case, data on per-cycle energy consumption will be available with MEA for all models sold in the market.

However, in the voluntary stage of the labelling program, labelling of washing machines will be voluntary and therefore MEA will have per-cycle energy consumption (EC) and import numbers only for models registered for the labelling scheme. In this case, the following approach is adopted for calculating the actual average energy consumption. **It is assumed that the EC of models not registered with MEA is equal to the baseline value.**



The adjustment of the average per-cycle energy consumption for the year is done using the following formula:

$$\text{Adjusted average EC} = L\% \times \text{Avg. EC} + (1 - L\%) \times \text{EC}_{\text{baseline}}$$

### 1.9.3. Calculation of average capacity

The calculation of average capacity for a financial year is completed in manner similar to the calculation of actual per-cycle energy consumption. **The sales-weighted capacity (in kg) is calculated for each washing machine category for each financial year.** A sample calculation is shown below:

S. No.	Model no.	Capacity (kg)	Sales for year 1	Sales for year 2
1	AAAAA	5	<i>Import values for year 1 corresponding to each EE band</i>	<i>Import values for year 2 corresponding to each EE band</i>
2	AAAAB	6		
...	...			
<b>Average capacity for the year (kg)</b>			5.34 kg	6.12 kg



### 1.9.4. Other assumptions

The other factors to be assumed are shown below:

Factor	Unit	Description
No. of cycles per year	-	Average no. of cycles run on a washing machine during the year
No. of years of operation	years	Washing machines sold offer energy savings during entire period of operation in the assessment period

The number of years of operation is important to calculate the net energy savings attributable to the washing machines sold during a particular year. For example, a washing machine sold in year 2 will continue to operate in year 4, providing a savings equivalent to 3 years.

**The no. of years of operation for a given year is the no. of years of operation during the assessment period or the life of the washing machine, whichever is less.**

**These values are fed into the calculation template and the final calculation is performed.**

### 1.9.5. Final results

The overall energy savings are automatically calculated in the template once the above values are fed in and are indicated in the “RESULT” worksheet, as shown below.

*Table 12: Illustrative result worksheet*

Semi-automatic machines	million kWh	
Top loaders	million kWh	
Front loaders	million kWh	
<b>Total energy savings</b>	<b>million kWh</b>	
	<b>MWh</b>	

# ***Indicator 2: Estimation of percentage of imported appliances present with a label***

The estimation of imported appliances with a label is important to assess whether the stakeholders are promoting the import of energy efficient appliances into the Maldives.

## **Sample form to estimate percentage of imported appliances present with a label**

<b>Form-1</b>		
<b>To be filled by the MCS for each appliance</b>		
<b>1. General details</b>		
<b>Product type</b>		
<b>Brand /make</b>		
<b>Model No.</b>		
<b>Models in the family (if any)</b>		
<b>Rated Voltage</b>		
<b>Average period of operation</b>		
<b>2. Label Details</b>		
<b>No. of appliances cleared per month</b>		
<b>No. of appliances with and without labels per month</b>	<b>With label</b>	
	<b>Without label</b>	

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## ***Indicator 3: Estimation of influence of label on consumer's purchasing pattern***

This chapter describes the overall essence of the procedure for conducting this task and designing the questionnaire. This task involves understanding the consumers' level of awareness and understanding of energy and on the factors that affect their purchases of energy-efficient appliances.

**These is best done by conducting frequent surveys across consumers and retail stores which sell appliances which come under the purview of the labelling scheme.**

A sample questionnaire **to be filled by consumers** can be used to understand the consumer's awareness about the program, energy efficiency in general and its influence on purchasing criteria. For example, MEA can initiate an annual survey at different retail stores using the following questionnaire for consumers.

**Sample questionnaire to estimate influence of label on consumers' purchasing pattern**

**Form-2**  
**To be filled by consumers**

**1. General details**

<b>Name of retailer</b>	
<b>Contact person</b>	
<b>Contact number</b>	
<b>Email address</b>	

**2. Label Details**

<b>Are you aware of the EE labelling program for appliances?</b>	<b>Yes/no</b>
<b>How important is energy efficiency as a criterion during purchase of an appliance?</b>	<b>Very Important Slightly Important Not Important</b>
<b>Please rank the various purchasing criteria from 1 to 7. (1 being the highest and 7 the lowest)</b>	<b><i>Brand, Features, Durability, Price, Performance &amp; Design</i></b>
<b>How effective do you think the EE labelling program for appliances has been?</b>	<b>Very Effective Slightly Effective Not Effective at all</b>
<b>Do you have any suggestions for the EE labelling program's improvement?</b>	

After discussing with stakeholders, the finalized survey questioner is provided in Appendix A.

## ***Indicator 4: Distribution of overall import of appliances into the five EE classes defined in the label***

It is important to understand the relative penetration of energy efficient appliances in the Maldivian market after the introduction of the EE labelling program. This exercise, in essence, will bring out the distribution of overall import of appliances over the five EE classes to understand the relative penetration. An illustration of the output is shown below:

<b>FY 2020 figures</b>			
<b>EE class</b>	<b>Washing machine</b>	<b>Air conditioner</b>	<b>Refrigerator</b>
<b>Level 5 (most efficient)</b>	35%	10%	20%
<b>Level 4</b>	15%	20%	20%
<b>Level 3</b>	40%	50%	20%
<b>Level 2</b>	5%	30%	20%
<b>Level 1</b>	2%	20%	20%
<b>Unlabelled</b>	3%	-	-

**Ideally, this exercise should be conducted annually and the table should be based on the import figures over the year.**

## ***2. Estimation of potential energy & cost savings attributable to the EE labelling program***

The previous chapter provided the monitoring and evaluation framework for the EE labelling program in the Maldives. The chapter also introduced the various indicators and their calculation methodologies. In addition, detailed excel-based templates for calculation of energy consumption was also provided.

**In this chapter, the team attempts to estimate the potential energy & cost savings attributable to the EE labelling program during the assessment period of ten year, i.e. from FY 2019 to FY 2030.**

While the overall methodology for calculation of energy savings remains the same as described in the previous chapter, additional assumptions are required given that this is an ex ante calculation and relevant information is generally unavailable. The potential energy savings & corresponding GHG emission reduction from implementing the EE labelling program for air conditioners, refrigerators and washing machines are described in subsequent sub-sections.

### ***2.1. Energy savings from air conditioners***

This section describes the procedure for estimation of net energy savings from air conditioners. **The total energy savings is the sum of annual energy savings attributable to refrigerators sold during each year of the assessment period.**

These calculations are based on the approach defined in Chapter 1. However, due to unavailability of actual data, the estimation is based on a few assumptions made by the project team based on our assessment of the on-ground situation in the Maldives.

#### ***2.1.1. Assumptions***

Following assumptions have been made for calculating the net energy estimation:

1. The period of assessment is taken to be 12 years, from FY 2019 to FY 2030.
2. The average life of an air conditioner is taken to be 10 years.
3. The air conditioner market in the Maldives is dominated by inverter type split air conditioners.
4. The average capacity of air conditioners sold in the Maldives is 2.6 kW
5. Air conditioners are run for an average of 12 hours per day, as per a survey conducted by ME.

#### ***2.1.2. Estimation of sales during the assessment period***

In the market assessment report shared by ME, the imports of refrigerators in numbers during FY2016 stood at 45,446 approximately, registering a five-year CAGR of 23%. The report estimated that the annual air conditioner imports to be over 60,000 by 2025.

Therefore, in our estimate, **we will assume a constant growth rate** in air conditioner imports, from FY 2019 to FY 2025 and beyond. As a result, the imports and hence the sales during the assessment period is shown in the following table.

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
<b>Imports/ sales</b>	47265	49812	52359	54906	57453	60000	62547	65094	67641	70188	72735	75282

### 2.1.3. Estimation of actual annual energy consumption

The information available on energy consumption values for air conditioners sold in the Maldives is insufficient. Therefore, an indirect approach which adopts additional assumptions for the baseline and final situation are taken as follows:

1. The approximate share of air conditioners before the implementation of the programme shall be as follows:

- 35% for Level 1 (least efficient)
- 3% for Level 2
- 20% for Level 3
- 10% for Level 4
- 5% for Level 5 (most efficient)

i.e. if we have 100 air conditioners of a particular category then 35 washing machines in that category shall be of level 1, 30 shall be of level 2, 20 shall be of level 3, 10 shall be of level 4, and 5 air conditioners shall be of level 5.

2. After the implementation of the EE programme, at the end of the assessment period, the share of air conditioners is assumed to be:

- 10% for Level 2
- 20% for Level 3
- 30% for Level 4
- 40% for Level 5

i.e. if we have 100 air conditioners of a particular category, then at the end of the assessment period, 10 washing machines in that category shall be of level 2, 20 shall be of level 3, 30 shall be of level 4 and 40 washing machines shall be of level 5.

3. The change in the share of washing machines for all the EE levels is assumed to be continuous and uniform over the period of assessment.

**Based on the above-mentioned assumptions, the distribution of sales is shown below:**

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Level 1	35%	32%	29%	25%	22%	19%	16%	13%	10%	6%	3%	0%
Level 2	30%	28%	26%	25%	23%	21%	19%	17%	15%	14%	12%	10%
Level 3	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 4	10%	12%	14%	15%	17%	19%	21%	23%	25%	26%	28%	30%
Level 5	5%	8%	11%	15%	18%	21%	24%	27%	30%	34%	37%	40%

**The SEER value corresponding to each level is assumed to be the maximum allowable energy consumption value to qualify for that level.** The actual energy consumption value equals the weighted average cooling energy produced divided by SEER value for that particular year.

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### **2.1.4. Estimation of baseline energy consumption**

Given the unavailability of data on the existing market conditions, estimation of baseline energy consumption for air conditioners in the Maldives based on quantitative data is unviable at present. As such, for the calculation, we have assumed that the baseline energy consumption is equal to the scenario in FY 2019.

### **2.1.5. Final energy savings and GHG emission reduction**

The values of the above parameters are fed into the calculation sheet provided as a part of Chapter 1. The final energy savings are replicated below:

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<b>Energy savings during assessment period</b>		
<b>Total energy savings</b>	<b>million kWh</b>	<b>1273.57</b>

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**Given a grid emission factor of 0.739 t-CO<sub>2</sub>/MWh<sup>2</sup>, the emission avoided equals 941,167 tCO<sub>2</sub>.**

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<sup>2</sup> [https://www.jcm.go.jp/mv-jp/methodologies/19/attached\\_document1](https://www.jcm.go.jp/mv-jp/methodologies/19/attached_document1) as retrieved on 26th June 2018.



## 2.2. Energy savings from refrigerators

This section describes the procedure for estimation of net energy savings from refrigerators. **The total energy savings is the sum of annual energy savings attributable to refrigerators sold during each year of the assessment period.**

These calculations are based on the approach defined in Chapter 1. However, due to unavailability of actual data, the estimation is based on a few assumptions made by the project team based on our assessment of the on-ground situation in the Maldives.

### 2.2.1. Assumptions

Following assumptions have been made for calculating the net energy estimation:

6. The period of assessment is taken to be 12 years, from FY 2019 to FY 2030.
7. The average life of a refrigerator is taken to be 15 years.
8. There are only four categories of refrigerators in the Maldives for the entire period of assessment. These categories are:
  - Refrigerator without freezer
  - **Refrigerators with freezer and adjusted volume  $\leq 300l$**
  - **Refrigerators with freezer and  $300l < \text{adjusted volume} \leq 900l$**
  - Refrigerators with freezer and TTD (Through the door) dispenser

### 2.2.2. Estimation of sales during the assessment period

In the market assessment report shared by ME, the imports of refrigerators in numbers during FY2016 stood at 14,100 approximately. Interestingly, the 5-year CAGR was approximately 2%. Therefore, assuming that the trend follows for another 3 years, imports during FY2019 will be around 14,963 given this trend. However, refrigerators are forecasted to reach around 15,000 by FY 2025.

Therefore, in our estimate, **we will assume a constant growth rate** in refrigerator imports, from FY 2019 to FY 2025 and beyond. As a result, the imports and hence the sales during the assessment period is shown in the following table.

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
<b>Imports / sales</b>	14,963	14,969	14,975	14,982	14,988	14,994	15,000	15,006	15,012	15,018	15,024	15,030

However, segregation of sales within the four categories is not clear as disaggregated data is not available. Given this situation, we shall refer to **the relative proportion** shared by STO, and assume that the proportion remains constant during the assessment period.

Imports	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
Ref without freezer	2544	2545	2546	2547	2548	2549	2550	2551	2552	2553	2554	2555	17%
Ref with freezer, adjusted vol < 300l	4339	4341	4343	4345	4346	4348	4350	4352	4354	4355	4357	4359	29%
Ref with freezer, 300l < adj vol <= 900l (including TTD)	4040	4042	4043	4045	4047	4048	4050	4052	4053	4055	4057	4058	27%

### 2.2.3. Estimation of actual annual energy consumption

The information available on energy consumption values for refrigerators sold in the Maldives is insufficient. Therefore, an indirect approach which adopts additional assumptions for the baseline and final situation are taken as follows:

- The approximate share of refrigerators before the implementation of the programme shall be as follows:
  - 50% for Level 2
  - 35% for Level 3
  - 10% for Level 4
  - 5% for Level 5
 i.e. if we have 100 refrigerators of a particular category then 50 refrigerators in that category shall be of level 2, 35 shall be of level 3, 10 shall be of level 4 and 5 refrigerators shall be of level 5.
- After the implementation of the EE programme, at the end of the assessment period, the share of refrigerators is assumed to be:
  - 5% for Level 2
  - 10% for Level 3
  - 35% for Level 4
  - 50% for Level 5
 i.e. if we have 100 refrigerators of a particular category, then at the end of the assessment period, 5 refrigerators in that category shall be of level 2, 10 shall be of level 3, 35 shall be of level 4 and 50 refrigerators shall be of level 5.
- The change in the share of refrigerators for all the EE levels is assumed to be continuous and uniform over the period of assessment.
- The average adjusted volume for the four categories of refrigerators are shown below:

<b>Ref without freezer</b>	<i>L</i>	120
<b>Ref with freezer, adjusted vol&lt;+300l</b>	<i>L</i>	292.75
<b>Ref with freezer, 300l&lt;adj vol&lt;=900l (including TTD)</b>	<i>L</i>	494.8
<b>Ref with freezer and TTD dispenser</b>	<i>L</i>	742.2

**Based on these assumptions, the distribution of sales among the 4 EE levels is shown below:**

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Level 2	50%	46%	42%	38%	34%	30%	25%	21%	17%	13%	9%	5%
Level 3	35%	33%	30%	28%	26%	24%	21%	19%	17%	15%	12%	10%
Level 4	10%	12%	15%	17%	19%	21%	24%	26%	28%	30%	33%	35%
Level 5	5%	9%	13%	17%	21%	25%	30%	34%	38%	42%	46%	50%

**The annual energy consumption corresponding to each level is assumed to be the maximum allowable energy consumption value to qualify for that level.** The actual energy consumption value equals the weighted average annual energy consumption for that particular year.

### 2.2.4. Estimation of baseline energy consumption

Given the unavailability of data on the existing market conditions, estimation of baseline energy consumption for refrigerators in the Maldives based on quantitative data is unviable at present. As such, for the calculation, we

have assumed that the baseline energy consumption is equal to the corresponding energy consumption value at the lowest EE level in the label.

### **2.2.5. Final energy savings and GHG emission reduction**

The values of the above parameters are fed into the calculation sheet provided as a part of Chapter 1. The final energy savings are replicated below:

<b>Energy savings during assessment period</b>		
Ref without freezer	<i>million kWh</i>	11.95
Ref with freezer, adjusted vol < +300l	<i>million kWh</i>	42.05
Ref with freezer, 300l < adj vol <= 900l (including TTD)	<i>million kWh</i>	40.64
Ref with freezer and TTD dispenser	<i>million kWh</i>	54.80
<b>Total energy savings</b>	<b><i>million kWh</i></b>	<b>149.44</b>

**Given a grid emission factor of 0.739 t-CO<sub>2</sub>/MWh<sup>3</sup>, the emission avoided equals 110,432 tCO<sub>2</sub>.**

<sup>3</sup> [https://www.jcm.go.jp/mv-jp/methodologies/19/attached\\_document1](https://www.jcm.go.jp/mv-jp/methodologies/19/attached_document1) as retrieved on 26th June 2018.

## 2.3. Energy savings from washing machines

This section describes the procedure for estimation of net energy savings from washing machines. **The total energy savings is the sum of annual energy savings attributable to washing machines sold during each year of the assessment period.**

These calculations are based on the approach defined in Chapter 2. However, due to unavailability of actual data, the estimation is based on a few assumptions made by the project team based on our assessment of the on-ground situation in the Maldives.

### 2.3.1. Assumptions

Estimation of energy savings requires use of a set of assumptions regarding the energy performance and sales of washing machines during the assessment period. Consequently, the following assumptions are made:

- The assessment period is FY2019 to FY 2030
- Given the import-driven nature of the Maldivian market, imports are taken as a substitute figure for sales in this assessment. Imports in a given financial year translate into sales in the given financial year.
- Sales are assumed to occur at the beginning of the financial year for simplicity of calculations.
- Top loaders and semi-automatic machines are assumed to run at the standard cotton 30 C programme and front loaders at the standard cotton 60 C.
- The total number of cycles per year is assumed to be 220, based on EU experiences.
- The life of a washing machine is taken as 7 years.

Estimation of other important parameters, such as baseline energy consumption, actual energy consumption, average capacity etc. are described in the following sub-sections.

### 2.3.2. Estimation of sales during the assessment period

In the market assessment report shared by ME, the imports of washing machines in numbers during FY2016 stood at 15,163. Interestingly, the 5-year CAGR was nearly zero. Therefore, we assume that imports during FY2019 was around 15,000 given this trend. However, washing machine imports are forecasted to reach around 25,000 by FY 2025.

Therefore, in our estimate, **we will assume a constant growth rate** in washing machine imports, from FY 2018 to FY 2025 and beyond. As a result, the imports and hence the sales during the assessment period is shown in the following table.

FY	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
<b>Import / sales</b>	15000	16667	18333	20000	21667	23333	25,000	26667	28333	30000	31666	33333

However, segregation of sales within top loaders, front loaders and semi-automatic machines is not clear. Consequently, we shall make an approximation of this figure from the responses of retailers on the questionnaire shared during the labelling programme development phase. A summary of the responses is shown in the following table.

	Lintel	STO	Monalals	Refcool	Reefside	AJE Emporium
<b>Segmentation of washing machine sales</b>	Semi-auto – 0% Top-loader – 18% Front-loader – 82%	Semi-auto – 33% Top-loader – 52% Front-loader – 15%	Semi-auto – 45% Top-loader – 50% Front-loader – 5%	-	Semi-auto – 5% Top-loader – 40% Front-loader – 40%	Semi-auto – 15% Top-loader – 50% Front-loader – 30%

Washer-dryer – 15%	Washer-dryer – 5%
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From the above table, it can be estimated that top loaders comprise approximately 50% of the market, front loaders approximately 30% and semi-automatic machines the remaining 20%. Given the lack of reliable data, we assume that this distribution remains unchanged during the assessment period. Therefore, segment-wise sales during the assessment period is shown below:

FY	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
<b>Imports</b>	15000	16667	18333	20000	21667	23333	25,000	26667	28333	30000	31666	33333
<b>Semi auto</b>	3000	3333	3667	4000	4333	4667	5000	5333	5667	6000	6333	6667
<b>Top loader</b>	7500	8334	9167	10000	10834	11667	12500	13334	14167	15000	15833	16666
<b>Front loader</b>	4500	5000	5500	6000	6500	7000	7500	8000	8500	9000	9500	10000

### 2.3.3. Estimation of average capacity

The market assessment report mentions that washing machines imported into the Maldives have a capacity ranging from 5 kg to 14 kg. However, this information is insufficient to estimate the average capacity of washing machines. This was enquired in the questionnaire shared with major retailers in the Maldives. Their responses are illustrated below.

	Lintel		STO		Monalals		Refcool		Reefside		AJE Emporium	
Segmentation of washing machines by capacity	Capacity range (kg)	%	Capacity range (kg)	%	Capacity range (kg)	%	Capacity range (kg)	%	Capacity range (kg)	%	Capacity range (kg)	%
	6 – 8	100 %	7 - 8	38 %	<5	5%	-	-	<5	30%	<5	-
			8 - 9	14 %	6-8	95%			6-8	70%	6-8	95%
			9-10	33 %							Above 8	5%
			11-14	12 %								
			>15	3 %								

As shown above, the majority of the imports lie between 6-8 kg range, and the rest above 8 kg. Consequently, we shall assume **the average capacity of washing machines as 7.5 kg for the purpose of the assessment.**

### 2.3.4. Estimation of actual per-cycle energy consumption

The information available on energy consumption values for washing machines sold in the Maldives is insufficient. Therefore, an indirect approach which adopts bold assumptions for the baseline and final situation are taken as follows:

- The approximate share of washing machines before the implementation of the programme shall be as follows:
  - 35% for Level 1 (least efficient)
  - 30% for Level 2
  - 20% for Level 3
  - 10% for Level 4
  - 5% for Level 5 (most efficient)

i.e. if we have 100 washing machines of a particular category then 35 washing machines in that category shall be of level 1, 30 shall be of level 2, 20 shall be of level 3, 10 shall be of level 4, and 5 washing machines shall be of level 5.
- After the implementation of the EE programme, at the end of the assessment period, the share of washing machines is assumed to be:

- 10% for Level 2
- 20% for Level 3
- 30% for Level 4
- 40% for Level 5

i.e. if we have 100 washing machines of a particular category, then at the end of the assessment period, 10 washing machines in that category shall be of level 2, 20 shall be of level 3, 30 shall be of level 4 and 40 washing machines shall be of level 5.

- The change in the share of washing machines for all the EE levels is assumed to be continuous and uniform over the period of assessment.

**Based on the above-mentioned assumptions, the distribution of sales is shown below:**

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
<b>Level 1</b>	35%	32%	29%	25%	22%	19%	16%	13%	10%	6%	3%	0%
<b>Level 2</b>	30%	28%	26%	25%	23%	21%	19%	17%	15%	14%	12%	10%
<b>Level 3</b>	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
<b>Level 4</b>	10%	12%	14%	15%	17%	19%	21%	23%	25%	26%	28%	30%
<b>Level 5</b>	5%	8%	11%	15%	18%	21%	24%	27%	30%	34%	37%	40%

**The per cycle energy consumption corresponding to each level is assumed to be the maximum allowable energy consumption value to qualify for that level.** The actual energy consumption value equals the weighted average per-cycle energy consumption for that particular year.

### **2.3.5. Estimation of baseline per-cycle energy consumption**

Given the unavailability of data on the existing market conditions, estimation of baseline energy consumption for washing machines in the Maldives based on quantitative data is unviable at present. As such, for the calculation, we have assumed that the baseline energy consumption is equal to the corresponding energy consumption value at the lowest EE level in the label.

### **2.3.6. Final energy savings and GHG emission reduction**

The values of the above parameters are fed into the calculation sheet provided as a part of Chapter 1. The final energy savings are replicated below:

<b>Energy savings during assessment period</b>		
Semi-automatic machines	<i>million kWh</i>	<b>3.02</b>
Top loaders	<i>million kWh</i>	<b>7.56</b>
Front loaders	<i>million kWh</i>	<b>27.46</b>
<b>Total energy savings</b>	<b><i>million kWh</i></b>	<b>38.04</b>

**Given a grid emission factor of 0.739 t-CO<sub>2</sub>/MWh<sup>4</sup>, the emission avoided equals 28,109 tCO<sub>2</sub>.**

## **2.4. Potential water savings from washing machine**

One of the major benefits of implementing an EE labelling program for washing machines is potential reduction in water consumption. This is especially true in the case of the Maldives, where reduction in water consumption directly translate into GHG emission reduction, given that desalination of water is an energy intensive exercise.

<sup>4</sup> [https://www.jcm.go.jp/mv-jp/methodologies/19/attached\\_document1](https://www.jcm.go.jp/mv-jp/methodologies/19/attached_document1) as retrieved on 26th June 2018.

This section describes the procedure for estimation of net water savings. **The total water savings is the sum of annual water savings attributable to washing machines sold during each year of the assessment period.**

These calculations are based on the approach defined in Chapter 2. However, due to unavailability of actual data, the estimation is based on a few assumptions made by the project team based on our assessment of the on-ground situation in the Maldives.

### 2.4.1. Assumptions

Estimation of water savings requires use of a set of assumptions regarding the energy performance and sales of washing machines during the assessment period. Consequently, the following assumptions are made:

- The assessment period is FY2019 to FY 2030
- Given the import-driven nature of the Maldivian market, imports are taken as a substitute figure for sales in this assessment. **Imports in a given financial year translate into sales in the same financial year.**
- Sales and imports are assumed to occur at the beginning of the financial year for simplicity of calculations.
- Top loaders and semi-automatic machines are assumed to run at the standard cotton 30 C programme and front loaders at the standard cotton 60 C.
- The total number of cycles per year is assumed to be 220, based on EU experiences.
- The life of a washing machine is taken as 7 years.

Estimation of other important parameters, such as baseline water consumption, actual water consumption, average capacity etc. are described in the following sub-sections.

### 2.4.2. Estimation of sales during the assessment period

In the market assessment report shared by ME, the imports of washing machines in numbers during FY2016 stood at 15,163. Interestingly, the 5-year CAGR was nearly zero. Therefore, we assume that imports during FY2018 was around 15,000 given this trend. However, washing machine imports are forecasted to reach around 25,000 by FY 2025.

Therefore, in our estimate, **we will assume a constant growth rate** in washing machine imports, from FY 2018 to FY 2025 and beyond. As a result, the imports and hence the sales during the assessment period is shown in the following table.

FY	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
<b>Import/ sales</b>	15000	16667	18333	20000	21667	23333	25,000	26667	28333	30000	31666	33333

However, segregation of sales within top loaders, front loaders and semi-automatic machines is not clear. Consequently, we shall make an approximation of this figure from the responses of retailers on the questionnaire shared during the labelling programme development phase. A summary of the responses is shown in the following table.

	Lintel	STO	Monalals	Refcool	Reefside	AJE Emporium
<b>Segmentation of</b>	Semi-auto – 0%	Semi-auto – 33%	Semi-auto – 45%	-	Semi-auto – 5%	Semi-auto – 15%

<b>washing machine sales</b>	Top-loader – 18% Front-loader – 82%	Top-loader – 52% Front-loader – 15%	Top-loader – 50% Front-loader – 5%		Top-loader – 40% Front-loader – 40% Washer-dryer – 15%	Top-loader – 50% Front-loader – 30% Washer-dryer – 5%
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From the above table, it can be estimated that top loaders comprise approximately 50% of the market, front loaders approximately 30% and semi-automatic machines the remaining 20%. Given the lack of reliable data, we assume that this distribution remains unchanged during the assessment period. Therefore, segment-wise sales during the assessment period is shown below:

FY	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
<b>Imports</b>	15000	16667	18333	20000	21667	23333	25,000	26667	28333	30000	31666	33333
<b>Semi auto</b>	3000	3333	3667	4000	4333	4667	5000	5333	5667	6000	6333	6667
<b>Top loader</b>	7500	8334	9167	10000	10834	11667	12500	13334	14167	15000	15833	16666
<b>Front loader</b>	4500	5000	5500	6000	6500	7000	7500	8000	8500	9000	9500	10000

### 2.4.3. Estimation of average capacity

The market assessment report mentions that washing machines imported into the Maldives have a capacity ranging from 5 kg to 14 kg. However, this information is insufficient to estimate the average capacity of washing machines.

This was enquired in the questionnaire shared with major retailers in the Maldives. Their responses are illustrated below.

	Lintel		STO		Monalals		Refcool		Reefside		AJE Emporium	
<b>Segmentation of washing machines by capacity</b>	Capacity range (kg)	%	Capacity range (kg)	%	Capacity range (kg)	%	Capacity range (kg)	%	Capacity range (kg)	%	Capacity range (kg)	%
	6 – 8	100 %	7 - 8 8 - 9 9-10 11-14 >15	38 % 14 % 33 % 12 % 3 %	<5 6-8	5% 95%	-	-	<5 6-8	30% 70%	<5 6-8 Above 8	- 95% 5%

As shown above, the majority of the imports lie between 6-8 kg range, and the rest above 8 kg. Consequently, we shall assume **the average capacity of washing machines as 7.5 kg for the purpose of the assessment.**

### 2.4.4. Estimation of actual per-cycle water consumption

The information available on water consumption values for washing machines sold in the Maldives is insufficient. Therefore, an indirect approach which adopts bold assumptions for the baseline and final situation are taken as follows:

- The approximate share of washing machines before the implementation of the programme shall be as follows:
  - 40% for Level 1 (least efficient)
  - 30% for Level 2
  - 20% for Level 3
  - 10% for Level 4
  - 5% for Level 5 (most efficient)



i.e. if we have 100 washing machines of a particular category then 40 washing machines in that category shall be of level 1, 30 shall be of level 2, 20 shall be of level 3, 10 shall be of level 4, and 5 washing machines shall be of level 5.

2. After the implementation of the EE programme, at the end of the assessment period, the share of washing machines is assumed to be:

- 10% for Level 2
- 20% for Level 3
- 30% for Level 4
- 40% for Level 5

i.e. if we have 100 washing machines of a particular category, then at the end of the assessment period, 10 washing machines in that category shall be of level 2, 20 shall be of level 3, 30 shall be of level 4 and 40 washing machines shall be of level 5.

3. The change in the share of washing machines for all the EE levels is assumed to be continuous and uniform over the period of assessment.

**Based on the above-mentioned assumptions, the distribution of sales among the 5 categories is shown below:**

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
<b>Level 1</b>	35%	32%	29%	25%	22%	19%	16%	13%	10%	6%	3%	0%
<b>Level 2</b>	30%	28%	26%	25%	23%	21%	19%	17%	15%	14%	12%	10%
<b>Level 3</b>	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
<b>Level 4</b>	10%	12%	14%	15%	17%	19%	21%	23%	25%	26%	28%	30%
<b>Level 5</b>	5%	8%	11%	15%	18%	21%	24%	27%	30%	34%	37%	40%

**The per cycle water consumption corresponding to each level is assumed to be the maximum allowable water consumption value to qualify for that level.** The actual water consumption value equals the weighted average per-cycle water consumption for that particular year.

### **2.4.5. Estimation of baseline per-cycle water consumption**

Given the unavailability of data on the existing market conditions, estimation of baseline water consumption for washing machines in the Maldives based on quantitative data is unviable at present. As such, for the calculation, we have assumed that the baseline water consumption is equal to the corresponding water consumption value at the lowest EE level in the label.

### **2.4.6. Cumulative water savings**

The values of the above parameters are fed into the calculation sheet provided as a part of Chapter 1. The final water savings are replicated below:

<b>Energy savings during assessment period</b>		
Semi-automatic machines	<i>million L</i>	<b>3472.80</b>
Top loaders	<i>million L</i>	<b>8681.99</b>
Front loaders	<i>million L</i>	<b>1926.04</b>
<b>Total water savings</b>	<b><i>million L</i></b>	<b>14080.83</b>

**Note:** The estimated water savings from front loaders is small compared to that of semi-automatic machines and top loaders because front loaders are already water efficient, and therefore consume far less water than the other two washing machine types.

### 2.4.7. Energy savings associated with supplying water

In addition to direct water costs, energy is also required to produce and supply water. Data from MWSC suggests that between 2.8 – 5 kWh of electricity are required to produce 1 CBM of water. This corresponds to additional energy savings between 39.42 to 70.40 million units of electricity by 2030.

## 2.5. Generation capacity avoided corresponding to energy savings from S&L programs

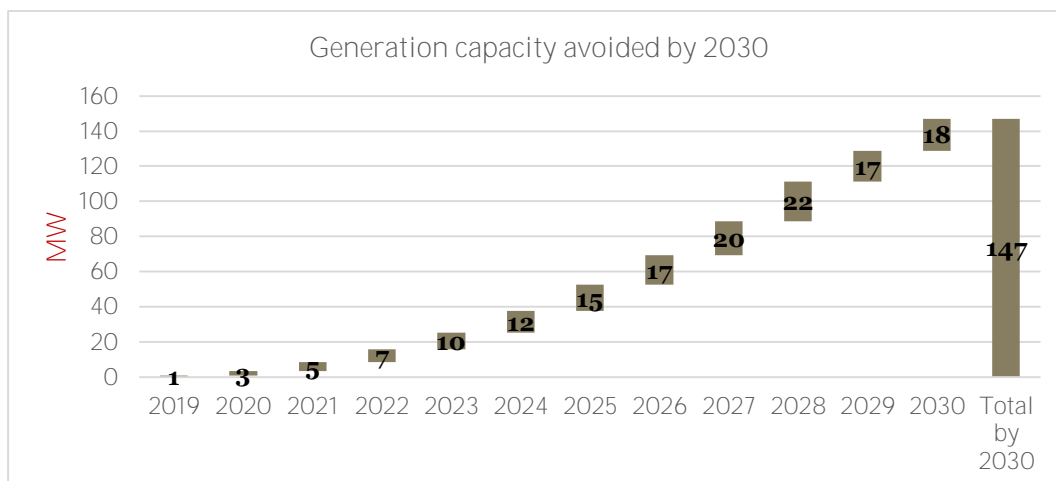
Implementing an energy efficiency standards & labelling program brings several benefits to both consumers and the nation as a whole. For the nation, direct benefits of increased efficiency accrue every year in terms of reduction in energy consumption and avoided GHG emissions. Reduced energy consumption also leads to reduced power demand in the long term. This in turn lowers reduced investment required in generation capacity.

The avoided generation capacity addition refers to the MW savings accrued with the implementation of standards & labelling program. This reduces the burden on the already constrained generation capacity of the nation.

The Avoided Generated capacity addition can be calculated by the formula:

$$\text{Avoided Generation Capacity addition} = \frac{\text{Number of appliances (avg. reduction in wattage)} \times \text{Peak Coincidence Factor}}{\text{Plant Load Factor (PLF) of power plant} \times (1 - \text{Transmission and Distribution Losses})}$$

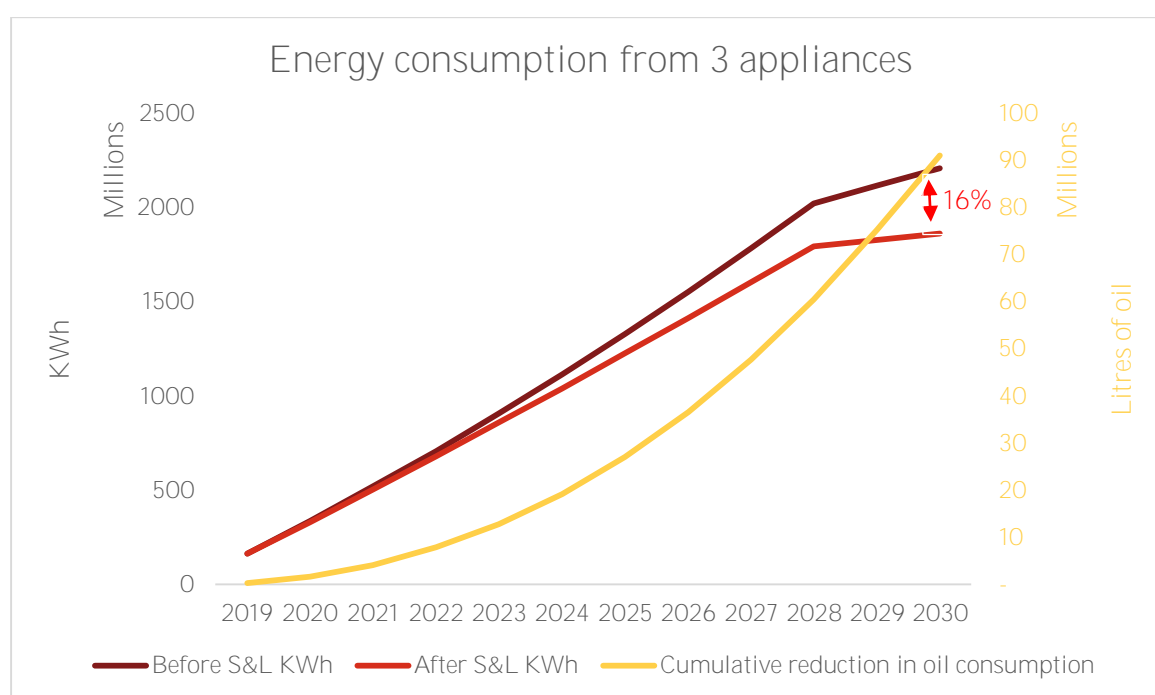
It is expected that the S&L program will result in avoiding the need for additional generation capacity by approximately 147 MW by 2030. Given a plant load factor of 0.83 across the Maldives, average transmission and distribution loss of 9%, and marginal cost of addition of 1 MW of generation capacity as \$359,790, **the S&L program for the three appliances is expected to avoid an expense of \$52 million by 2030** (corresponding to reduction in investment required for setting up generating units). The annual reduction due to the S&L program is illustrated in the following chart:



### 3. Summary of impact of implementing the S&L program

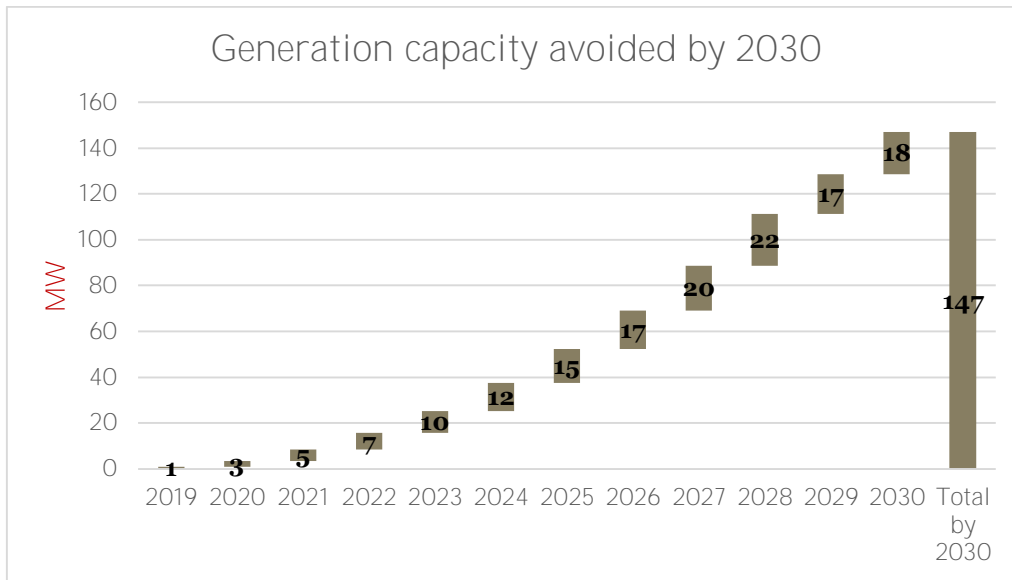
It is estimated that the S&L program for the three appliances will result in overall reduction of energy consumption of 1,326 million kWh, GHG emission reduction of 980,321 tCO<sub>2</sub> equivalent and reduction in 147 MW of generation capacity by 2030. **Most of these savings will be accrued from the residential and commercial sector.**

Overall, the total energy consumption in the baseline scenario (without energy labelling) and the ideal scenario (with labelling implementation) contributed from the three appliances by 2030 is shown below. Overall, by 2030, the proposed standards & labelling program will reduce the aggregate energy consumption from the 3 appliances by 16%.

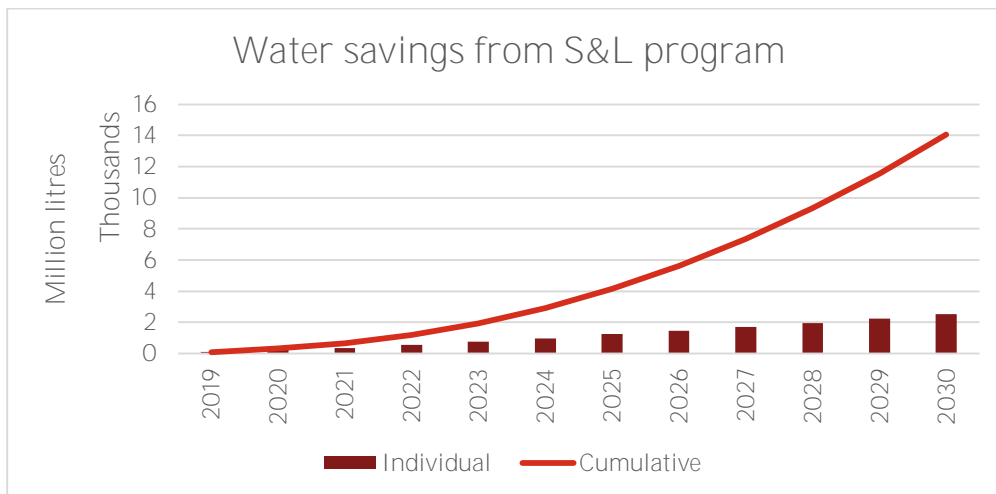


There are several benefits associated with implementation of the proposed labelling program:

- Assuming an average tariff of MVR 2.32/ KWh and an average government subsidy of 50% of that amount, the exchequer will avoid subsidy costs amounting to MVR 24.36 million by 2030 alone from these appliances.
- Further, avoided energy consumption corresponds to a reduction in oil import. According to MEA, one liter of oil is required to produce 3.8 KWh of energy at the consumer's end in Male. Assuming these statistics to hold over the next 10 years, the energy efficiency labelling program will result in avoiding consumption of 91 million Liters of oil by 2030.
- Further, it is expected that the S&L program will result in avoiding the need for additional generation capacity by approximately 147 MW by 2030. Given a plant load factor of 0.83 across the Maldives, average transmission and distribution loss of 9%, and marginal cost of addition of 1 MW of generation capacity as \$359,790, the S&L program for the three appliances is expected to avoid an expense of \$52 million by 2030 (corresponding to reduction in investment required for setting up generating units). The annual reduction due to the S&L program is illustrated in the following chart:



- In addition, the S&L program from washing machines will result in water savings of approximately 14,080 million L. The water saving for the next 10 years is shown below for washing machine



- A water saving of 14,080.3 million L corresponds to almost 2,816 million 5L water bottles! Assuming an Average direct water production cost for the Maldives at MVR 19.5 per CBM (or MVR 19.5 per 1000 L), this corresponds to a saving of MVR 274.6 million by 2030.
- In addition to direct water costs, energy is also required to produce and supply water. Data from MWSC suggests that between 2.8 – 5 kWh of electricity are required to produce 1 CBM of water. This corresponds to additional energy savings between 39.42 to 70.40 million units of electricity by 2030.

**Overall, the total benefits of implementing the standards & labelling program for the 3 appliances is summarized below:**

<b>By 2030</b>	<b>Air conditioner</b>	<b>Refrigerator</b>	<b>Washing machine</b>
Reduction in direct energy consumption	1273.57 million kWh	14.94 million kWh	38.04 million kWh
Generation capacity avoidance	121.20 MW	6.56 MW	19.31 MW
Reduction in water consumption	-	-	14,080 million L
Additional energy savings due to reduction in water consumption	-	-	39.42 to 70.40 million kWh
GHG emission reduction	941,186 tCO <sub>2</sub> equivalent	11044 tCO <sub>2</sub> equivalent	28109 tCO <sub>2</sub> equivalent Additional 40,582 tCO <sub>2</sub> equivalent due to water savings
Overall reduction including direct & additional energy savings due to reduction in water consumption	1,365.98 – 1,396.96 million kWh		
Overall generation capacity avoidance	147 MW		
Overall GHG reduction	1,020,903 tCo <sub>2</sub> equivalent		

## 4. Methods to improve impact of labelling program over the years

Periodic revisions to the efficiency requirements in a labelling program is frequent observed in all well-established labelling programs across the globe. For example, the labelling program for air conditioners in India has been revised (strengthened) four times since its inception in 2008. In the EU, revisions have been made to labelling programs for almost all appliances covered under the scope. This is because, over time, the sales weighted average efficiency of appliances in the market improve as a consequence of the labelling program.

However, with improved efficiency over time, the impact of the labelling programme reduces over time and necessitates revisions in the labelling scheme and the minimum energy performance standards. Therefore, strengthening the requirements for the labelling program in the Maldives over time is both necessary and consistent with international practices.

This section describes the circumstances which imply the stagnation of impact of the labelling program and how MEA can strengthen the MEPS level and/or labelling criteria to increase savings from the labelling program. The circumstances under which revision of MEPS level may be required can be identified using specific data-based indicators. A list of possible indicators and critical observations are described in the following table.

*Table 13: List of applicable indicators*

S. No.	Indicator	Critical observations
1	Distribution of annual sales/imports among the five efficiency bands	Concentration of sales in the higher efficiency bands indicate that the potential impact of the labelling program will be less in the following year.  <i>For example, if top 3 tiers (star bands) contribute to 80% of sales of washing machines, MEA can decide to strengthen the MEPS requirements for the program.</i>
2	Percentage of retailers importing appliances which have low efficiencies	If the sales of inefficient appliances are attributable to only a few retailers, this may be an indication of a need to strengthen the MEPS level of the labelling program.
3	Change in sales-weighted average efficiency level	If the year-on-year change in sales-weighted average efficiency levels have stagnated over 2-3 years, this may be an indication of need to strengthen the MEPS level of the labelling program.

In each of the above cases, the critical observations may be caused by factors other than stagnation of potential impact of the labelling program. For example, very low changes in the sales-weighted average efficiency levels may be caused by low consumer awareness than stagnating growth. Therefore, while using these indicators, one must analyze the causes behind the observations before reaching conclusions.

However, once it is identified that there is a need to strengthen the requirements of the labelling program, the regulator (i.e. MEA) can adopt either or both of the following options:

- Increase the minimum requirement for an appliance to qualify for the labelling program. In other words, strengthen the MEPS requirements for the program.

- 
- Strengthen the criteria for each efficiency tier. For example, the criteria for achieving the highest efficiency band for an appliance can be made stricter, such that a 4-star rated appliance is now 3-star.

Either scenario will independently lead to improvement in average market efficiency levels, as long as the stagnation is not caused by other factors.

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## 5. Feasibility of restricting imports

For an import based appliances market in Maldives, regulation on energy efficiency labelling of air conditioner, refrigerators and washing machine is bound to limit the import of inefficient models. This chapter discusses how an energy efficiency programme interacts with other policies and programs to create an effective and sustainable market transformation strategy towards the sales of EE products.

### *Management of Supply and Demand*

For the purpose of understanding, the present demand can be divided into two broad categories: A) low-cost and low-efficiency products; B) higher-cost and moderate to high efficiency products. With the implementation of energy efficiency labelling and MEPS regulations in Maldives, some category A products currently imported and sold in the market would face restrictions on further imports. The importers, distributors and retailers would perhaps replace these category A products with those available in category B. As a result, not only the demand of energy efficient products will increase but also there will be an increase in first costs for the consumers.

MEA and Ministry of Environment could accelerate adoption and penetration of energy efficient products in the market by influencing the supply distribution, wholesale and retail purchases. This could be accomplished through incentive programs such as:

- Innovative financing schemes for consumers to influence their purchase decision in favour of energy efficient appliances
- Enhancing availability of energy efficient appliances in the market through amending regulations for public procurement and other bulk procurers (guest-houses, etc.)

The product covered in the labelling program will provide the necessary regulatory criteria for meeting eligibility requirements in above cases.

Incentive programs for energy efficient products could be useful in influencing wholesale and retail stocking decisions, bringing down the first costs of these products and stimulating consumer interests. In order to run a successful incentive program, MEA would be required to coordinate with importers, distributors and retailers in advance and carefully plan the timing of these programs to avoid problems such as initial supply shortages which could lead to increased prices. Training workshops could be conducted to specifically target the importers, distributors and retailers to emphasize how the sale of efficient products can increase market share and profit.

### *Consumers' willingness to purchase efficient products*

The Ministry of Environment surveyed 1,873 households sampled across Maldives to collect information on consumer behaviour and their references regarding energy efficiency.<sup>5</sup> It was found that 72% of the households were willing to pay additional amount to purchase energy efficient products. It was also noted that the 57% of the households which did not implement energy efficiency measures stated lack of resources and lack of information as the two main reasons. In order to eliminate these barriers and enhance the adoption of energy efficient products, MEA could educate wholesalers, distributors and retailers on the use of payback analysis for sales and marketing of such products. An illustrative payback analysis is shown in the Table 14 for the 3 appliances proposed for energy efficiency labelling in Maldives. The payback analysis can be divided into two parts:

1. **Cost savings:** The Ministry of Environment is required to establish energy efficient appliances are cost-effective for consumers. Manufacturers and retailer could guarantee that the higher cost of an energy efficient appliance will be recovered **through electricity savings within the product's lifetime.** For example, residential air conditioners under the labelling programme have a payback period of 1.8 years, compared to an average lifetime of 10 years.
2. **Energy savings:** Energy efficient appliances use technologies that are less energy intensive to reduce the amount of electricity used per product. For example, compared to a 1-star air conditioner, the 5-star rated product uses 230 watts lesser power and saves 460 kWh of energy annually.

The cost and energy saving for the 3 appliances are shown in the below table.

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<sup>5</sup> Source: Ministry of Environment website – Research on Consumer Behaviour and Preferences Regarding Energy Efficiency in Households – July 2017



Table 14: Savings and Payback analysis<sup>6</sup>

<b>Energy and Monetary Savings</b>					
<b>Appliance</b>	<b>kW reduction per unit of efficient product</b>	<b>Annual usage hours</b>	<b>Annual energy saved (kWh/yr.) for one unit</b>	<b>Energy Tariff (MVR/kWh)<sup>7</sup></b>	<b>Annual Monetary savings (MVR)</b>
Air Conditioner	0.23	2000	460	5.5	2,530
Refrigerator	0.02	8760	156	5.5	858
Washing Machine	0.30	5110 cycles	500	5.5	2,750
<b>Payback Analysis</b>					
<b>Appliance</b>	<b>Cost of lowest star model (MVR)</b>	<b>Cost of 5 star model (MVR)</b>	<b>Cost increment due to efficient model (MVR)</b>	<b>Annual Monetary savings (MVR)</b>	<b>Simple payback (Years)</b>
Air Conditioner	6,200	10,800	4,600	2,530	1.8
Refrigerator	2,880	3,700	820	858	1.0
Washing Machine	8,200	21,500	13,300	2,750	4.8

The above-mentioned scenarios highlight that both – availability and affordability, of energy efficient appliances are favourably impacted through the following:

- Direct cost saving for the consumer by use of energy efficient products
- Direct incentives to consumers through innovative financing mechanisms to boost the import of energy efficient appliances and addressing bottleneck of higher upfront price
- Increasing the availability and share of energy efficient appliances in market by regulatory measures for public offices and bulk procurers

Collectively, these factors point towards a favourable situation for restricting the import of low-efficiency appliances in Maldivian market.

<sup>6</sup>Analysis based on comparison of 12,000 BTU/hr Inverter Split Air conditioner, 190L Double door Refrigerator Freezer, and 7kg Front Load Washing Machine.

<sup>7</sup> Source: MEA website; Highest Energy Tariff has been assumed.

# Appendix A. - Questionnaire format

## Estimating influence of label on consumers' purchasing pattern

<b>Gender of the respondent:</b>	Male/Female		
<b>Age of the respondent</b>	a. 18 – 35 years b. 35 – 64 years c. 65 and above		
<b>Have you recently purchased/ are you considering to purchase one of the following appliances?</b>	<b>Air conditioner</b>	<b>Refrigerator</b>	<b>Washing machine</b>
<b>Are you aware of the EE labelling program for appliances?</b>	Yes/No		
<b>How important is energy efficiency as a criterion during purchase?</b>	1. Very Important 2. Slightly Important 3. Not Important		
<b>Please rank the various purchasing criteria from 1 to 7. 1 being the highest and 7 the lowest</b>	<b>Criteria</b>	<b>Rank</b>	
	Performance		
	Cost		
	Brand		
	Durability		
	Features		
	Design		
<b>Energy Label</b>			
<b>How effective do you think the EE labelling program for appliances has been?</b>	1. Very Effective 2. Slightly Effective 3. Not Effective at all		
<b>Do you have any suggestions for the EE labelling program's improvement?</b>			



**Ministry of Environment**

# Development of and Implementation of Standards and Labelling Programme in the Maldives

*Implementation plan for Rolling out EE Labelling  
Programme – Task 6*

Strengthening Low Carbon  
Energy Island Strategies (LCEI) Project



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## List of abbreviations

EE	Energy Efficiency
M&V	Monitoring and verification
MEA	Maldives Energy Authority
MCS	Maldives Customs Services
MED	Ministry of Economic Development
TTD	Through The Door Dispenser
ME	Ministry of Environment
FOB	Free On Board

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# *1. Assessing capacities in implementing the different elements of EE labelling programme*

The purpose of the energy efficiency labelling program in the Maldives is to ensure that awareness of consumers about energy efficiency becomes a key criteria during purchase of an appliance. The benefits from S&L programme can only be realized if the program design is robust and the capacity within the implementing organization is strengthened. The readiness of the country for implementing the S&L program for household equipment must be reviewed on the basis of its capacity to implement various levels of EE labelling programme.

This section discusses about different elements that have been defined in the EE labelling programme, and the assessment capacities required within the key stakeholders /regulatory body in the Maldives to implement the programme.

The elements of the EE labelling programme have been defined as per their occurrence in the programme. They are as follows:

## *1.1. Elements of EE labelling programme*

### *1.1.1. Programme development and implementation*

In the stage of application processing, the application sent by the applicant to the MEA to register its products and make them eligible for EE labelling is evaluated, and a clearance is given to the import of these products.

The four major elements of EE labelling programme involved in this stage are as follows:

#### S&L framework development

The S&L framework development stage refers to the development of a code of conduct required to be followed by the MEA in order to award a certain EE label to the appliance that is being imported by the importers and dealers in the country.

The S&L programme includes the assessment of the existing global S&L programs, their relevance to the Maldivian market and the introduction of a set of standards based on which the appliances in Maldives shall be tested and a label as per the programme methodology shall be developed.

#### Application processing

This stage refers to the steps based on which the applicant may be able to submit a certain set of details, related to the organization and the products, so that MEA can record the information as a database and process the information to categorize the products into a specific label grade.

It is the responsibility of the applicant to submit the required details to the MEA in the prescribed formats, which are floated by the MEA.

#### Evaluation

The evaluation stage refers to a set of steps that are taken to evaluate the information submitted by the applicants to verify whether the proposed grade & other details are correct.

The evaluation is done based upon specific technical parameters of a particular appliance, using a tool designed for the purpose.

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## Approval for labelling

This stage refers to the approval given to the applicant for affixing EE label on the appliances that have been approved for EE labelling. After the data is scrutinized in the evaluation stage, the final database is created for keeping a record on the EE labelled appliances that are to be imported/exported into the Maldives by the applicants. The approval is sent to the applicant, stating that the respective appliance model as applied by the applicant for EE labelling comes under the regulations of the MEA, and that the following can be imported into the Maldives.

The MEA confirms the approval and/or rejection of the appliance to the applicant. The applicant then initiates the process to import the approved appliances to the Maldives. The updated database is stored with additional columns such as Grade allotted and Approval status.

The MEA also sends a copy of the details of the approved appliances to the MCS, so that MCS is aware of the products and the parameters based on which the imported products are required to be checked.

### *1.1.2. Monitoring, verification and enforcement*

The MV&E stage is required to ensure the effective adoption of the energy efficiency labelling programme. M&V ensures that stakeholders are adhering to the provisions of the scheme and their label correctly describes the performance of the appliances. MV&E is important to maintain consumer confidence of the labelling scheme, and is crucial to achieve its potential savings.

#### Inspection

Inspection is conducted to check whether the contents of the label affixed on each appliance match those approved by MEA. Confirming whether the label is affixed properly is also covered.

To conduct these inspections, a comprehensive inspection process is required. The inspection officers have to visit the point of inspection and conduct an inspection of the label affixed on the appliances. Comparison of the label with the one approved by MEA is done to assess whether the appliance passes the inspection or not.

#### Verification

Verification testing is conducted to check whether the performance of the appliance is as described by the label approved by MEA. This involves sampling of labelled appliances and performing verification testing in independent accredited laboratories. The test results are then evaluated to judge the performance of appliance.

#### Penalty for defaulters

There are provisions that allow the MCS to impose penalties and punishments on the defaulters for their non-compliance and other defaults. The MCS can penalize the defaulters for the following:

- Import of excess goods than declared.
- Furnishing false information to the customs.
- Broken seal affixed by the customs.
- Non-declared items.
- Unauthorized persons, vehicles and crafts.
- For items arriving with no inward clearance.
- For items arriving via smuggling.
- For items arriving via unofficial ports.

Customs may penalize the defaulters in the following ways, depending on the severity, for infringing the Customs Law and Regulations.

- Notify to correct by advice

- Fine
- Temporary withholding of the license or registry or pass issued by the Customs.
- Invalidate the license or registry issued by the Customs
- Send the case to the Prosecutor General Office to file a lawsuit in court, after the investigation.

In case the non-compliance has been established related to the requirements under S&L programme, the applicant of the respective product label shall be penalized. The provisions of penalty as defined under the **Customs' law shall be imposed as applicable.**

### *1.1.3. Awareness and outreach*

In the awareness and outreach stage, the consciousness about EE labelling programme is created through various mediums of advertisements and awareness. These may include:

Exhibit 1. - Print media such as:

- Newspaper article/ advertisement
- Magazine
- Brochures
- Leaflets

Exhibit 2. - Audio/ visual medium such as:

- Posters and billboards
- Radio advertisements
- TV advertisements
- Documentaries

Exhibit 3. - Advertisements on the website

Exhibit 4. - Advertisements on the mobile app

### *1.1.4. Impact assessment*

The impact assessment of EE labelling program is conducted to evaluate whether the program is running smoothly and the objectives of the program are being met. In situations where this is not so, it helps to identify the voids – whether in implementation, program structure or other areas – which can be resolved to ensure that the program meets its intended purpose.

The elements of EE labelling programme involved in the impact assessment are as follows:

#### Assessment

The impact assessment for the EE labelling programme is defined by segmenting the overall project into its various activities, each of which have intended outcomes and these outcomes lead to the main goal/objective of the program. Then, against each activity, output and goal, indicators are identified to assess whether the activity has met its intended targets. Once the indicators are defined, the corresponding baseline values are determined at the start of the program for each indicator. During the project, the values of the indicators shall be compared with the baselines to measure success/failure of the project.

#### Learnings

The assessment is then analyzed to determine whether the implementation of the EE labelling programme is meeting the initial objectives of the project or not.

The capacity assessment for the elements discussed above is required in order to assess the current capacities and requirements needed to strengthen the EE labelling programme. This can be done as follows:



## 1.2. Capacity required for implementation of S&L programme elements

The Maldives Energy Authority (MEA) as an implementing body for the S&L programme needs to create an institutional infrastructure with clear responsibilities for implementing the various elements of the programme. Many of the functions required within the various elements of the S&L programme are specific to the programme design and require a dedicated team for regular operations. Strong institutional capacity is critical to ensuring the effectiveness of energy efficiency policies and programs. In particular, the S&L programs require adequate personnel, institutional and financial resources for effective implementation.

Presently, the MEA is in the phase of designing the S&L programme. There is no defined institutional structure and MEA is in the process of creating the requisite infrastructure. In the following table, a list of key capacity requirements are mentioned, which the MEA and other stakeholders needs to build for a successful implementation.

Table 1: Key requirements

Element	Scope of the element	Stakeholder in-charge	Capacity required
Programme development and implementation	<ol style="list-style-type: none"> <li>1. Application Processing</li> <li>2. Evaluation</li> <li>3. Approval for testing</li> </ol>	MEA, ME	<ul style="list-style-type: none"> <li>• ME should have the mandate to design and develop the standards and labels.</li> <li>• MEA shall formulate technical committee(s) of stakeholders to develop the standards, discuss any aspect related with the programme. The technical committee shall be formulated either product-wise or a combined committee for a segment of products.</li> <li>• A team of technical officials is required to manage the programme in its entirety and to supervise the process and applications.</li> <li>• The technical team requires IT support staff to maintain the applications records in a definite database, process the application further and other staff to perform the clerical work required in the programme development and implementation.</li> </ul>
Monitoring, verification and enforcement	<ol style="list-style-type: none"> <li>1. Inspection</li> <li>2. Verification-testing</li> <li>3. Penalty for defaulters</li> </ol>	MEA MCS	<ul style="list-style-type: none"> <li>• The MEA shall have the mandate to inspect the appliances for any non-compliance and send them for verification testing.</li> <li>• A team of technical officials is required within MEA to implement the MV&amp;E requirements within the programme such as: identify the test labs at which verification testing shall be done; identify the points of inspection, travel to the inspection locations and inspect and analyze the appliances for non-</li> </ul>

			<p>compliances. The technical team shall contain surveillance officers.</p> <ul style="list-style-type: none"> <li>• The technical teams require support staff to append the data analyzed into specific database, and update the databases as when required. The support staff shall also act as a bridge between the MEA and the MCS to share the information relevant to customs clearance.</li> <li>• The MEA may hire a third party (if required) to implement the inspection programme for the appliances. The inspection officer should have a graduation degree as minimum qualification along with training course completed. Provisions for hiring of third party should be available within the mandate.</li> </ul>
Awareness and outreach	Outreaching the end consumers through various mediums of awareness and advertisement.	MEA	<ul style="list-style-type: none"> <li>• The MEA has the mandate to implement an outreach and awareness programme.</li> <li>• Awareness and outreach experts are required to devise the strategy to reach to the consumers for the promotion of EE labelling programme.</li> <li>• The MEA requires IT support staff to involve them into outreach programme for website designing, mobile app development and management.</li> </ul>
Impact assessment	To evaluate whether the program is running smoothly and the objectives of the program are being met.	MEA	<ul style="list-style-type: none"> <li>• The MEA requires the mandate to perform the impact assessment for the EE labelling implementation programme.</li> <li>• The technical team within MEA for S&amp;L programme is required to develop the impact assessment methodology and assess the impact of the implementation of the programme for a definite time period.</li> <li>• IT support staff is required to support the technical team for impact assessment requirements and maintain a record of the results of the impact assessment as done by the technical team.</li> </ul>



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## 2. Identifying the cost of implementing EE Labelling programme and options for recovering those costs

The implementation of EE labelling programme is a comprehensive process, which requires resources and tools at various stages of implementation. The cost of acquiring and maintaining these resources, which shall be incurred by the MEA, is identified in this section. The cost of implementation of EE labelling programme is also explained in detail with the help of a case study. Based upon the cost prediction tool that has been designed for the same, few key questions arise, that shall be answered by the MEA in order to identify the implementation cost accurately.

### 2.1. Resource costing

The resource cost is defined as the costs of all elements used to carry out business activities, including such elements as staffs' salaries and the cost of materials. For the EE labelling programme, the resource costs shall include the staff that has been allotted the task to implement and monitor the EE labelling programme. This staff can be categorically divided into two major teams:

#### Technical team

The technical team looks after the overall administration, implementation and monitoring of the programme. Administrative team may include following designations:

- Programme Manager: Manages the overall implementation of the programme (1 position)
- Programme Officer/ Application Manager: Manages the applications received by the applicants' organization (2-3 positions)
- Surveillance officers: to carry out market surveillance, verification and testing (2 positions)
- Awareness and outreach expert: Responsible to increase the consumer awareness about the EE labelling programme through various mediums of advertisement (1-2 positions)

#### Support team

The support team supervises the technical aspects of the project, and assists the administrative time to analyze the data, store the data in a defined database, help in creating awareness by designing mobile apps and website, and maintain a record of contact and data shared between MEA and other stakeholders. The support team also consists of clerical staff. The support team may consists of IT Specialist/ Database Manager (1-2 positions).

#### Cost related parameters

While estimating the resource cost, following parameters shall be accounted:

- Designation of the resource and total no. of posts for the same designation
- Initial salary per annum to the resource
- Annual increment for a particular designation (in %)
- Base year for the initial salary
- Current year

These parameters shall be recorded in a tabular form and the final resource cost shall be calculated using these parameters.

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## 2.2. Information technology (IT) services cost

The IT services cost is borne by the organization in implementing, assisting and monitoring the technical aspects of the EE labelling programme.

A separate IT services firm shall be hired for the same, whose cost shall include the following costs:

**Recording of approval/ rejection of label:** The IT services shall create and maintain a record for a particular appliance as per the approval or rejection of its label.

**Communication with applicants/ stakeholders:** The IT services shall keep a record of communication between different stakeholders as to what data has been shared between them, what information is required and whether the applicant needs to revert back to the MEA or the MCS for further processing or not.

**Surveillance application:** IT services shall maintain the surveillance record which may include:

- Non-compliant appliances
- Non-compliance per store location
- No. of appliances passed/ failed the inspection

**Awareness/ outreach application:** The services shall be responsible for the outreach programme through digital marketing campaigns, posters, maintaining a digital profile for consumer awareness etc.

**Public portal maintenance:** A public portal/website shall be created by the IT services that contain all the information about the EE labelling programme, including:

- The applicants that have been approved/ rejected
- The appliances that are to be imported and the import status
- Technical details of the appliances
- Label grade allotted to the appliance
- Customs related documents and clearance required
- Facility to the applicants to apply for the EE labelling programme online

**Mobile app management:** The mobile app shall include the same features as that of a public portal/ website.

The IT services cost by the third party calculation shall include the following parameters:

- The net cost incurred for IT services.
- YoY inflation rate in the Maldives for that particular year.
- The year for which cost analysis is done.

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## 2.3. Surveillance related cost

The surveillance includes two major aspects, **label inspection** and **verification/testing**.

Following surveillance costs shall be incurred due to the market inspection:

- Verification testing cost: The cost incurred for verification testing. This shall depend upon the type of appliance and laboratory. For every appliance (air conditioner, refrigerator and washing machine), the cost of transportation, and testing will be different. The testing cost per product shall be multiplied by the total no. of products considered as samples to calculate the final cost of testing. For every test lab location, the cost of transportation and other expenses shall be calculated and added to get the testing cost.
- Label inspection: This refers to the cost incurred for carrying out inspection in the local regions of Maldives. Here the cost is mostly related with travel expenses, cost of inspection devices and staff inputs.

Both the costs shall be added to determine the net surveillance cost.

## 2.4. Awareness and outreach cost

The awareness and outreach cost calculation shall include the following parameters:

- Cost incurred due to print media such as:
  - ✓ Newspaper article/ advertisement
  - ✓ Magazine
  - ✓ Brochures
  - ✓ Leaflets
- Cost incurred due to audio/ visual medium such as:
  - ✓ Posters and billboards
  - ✓ Radio advertisements
  - ✓ TV advertisements
  - ✓ Documentaries
- Cost incurred due to advertisement on the website
- Cost incurred due to the advertisements given on the mobile app

The cost calculation shall be done using these parameters:

- Frequency of outreach of a particular medium
- Average cost per occurrence

## 2.5. Cost recovery options

Cost recovery refers to the methods via which the cost incurred to the organization can be recovered. This is done through various fees, penalties and other mediums imposed by the organization.

The cost recovery can be done through these major options:

### Fees

Cost recovery through fees is an efficient method to recover the cost incurred. In the entire implementation programme, different types of fee can be imposed. This can be explained through the case study of the energy efficiency standards and labelling programme in India:

### *Case Study: Provision for fee in EE labelling programme in India*

In order to participate in the labelling programme in India, participants are required to deposit fee at various stages of the Indian EE labelling programme. These are as follows:

#### *1. Security deposit*

The security deposit fee is deposited by the applicant at the time of the registration of the company. Although the security deposit is refundable, the interest on the same goes to the cost recovery of the organization.

The amount is 100,000 INR (22,600 MVR) which is to be submitted as the security deposit

#### *2. Application fee*

Application fee is a non-refundable fee that is to be submitted by the applicant per appliance at the time of registration.

The amount is 2,000 INR (450 MVR) which is to be submitted as the application fee.

#### *3. Labelling fee*

The labelling fee is also submitted by the applicant per appliance to make the appliance eligible for labelling.

The approximate value of labelling is 0.1% of the cost of the appliance.

## *Case Study: Provision for fee in EE labelling programme in Singapore*

In order to participate in the labelling programme in Singapore, participants are required to deposit the following fees while applying for the labelling programme.

### *1. Registration fee*

There is no registration fee required to apply for registration of a supplier/manufacturer.

### *2. Security deposit*

There is no security deposit required in order to register any appliance for labelling. However, a large penalty of 2,000 SGD (22,750 MVR) is charged for any non-compliance issues from the registered supplier/manufacturer. The guidelines for such penalties are mentioned in the schedule of the regulation.

### *3. Application fee*

Application fee which is non-refundable, is to be submitted by the applicant per appliance at the time of registration. The application fee for renewal of each appliance is required to be submitted by the registered supplier when there is a change in specifications or energy efficiency grade.

The amount to be submitted as application fee is 34 SGD (380 MVR) and for renewal of application is 18 SGD (200 MVR).

### *4. Labelling fee*

There is no labelling required in the Singaporean energy labelling programme.

## **Penalties**

In case of non-compliance the applicant may be imposed a fine /penalty as per the powers within MCS for penalties to be imposed on the products for non-compliance. That can be a medium of cost recovery as well.

Therefore, the following can be the cost recovery options for the Maldives for the EE labelling programme

- **Security deposit fee** that is to be submitted per applicant.
- **Application fee** that is to be deposited by every applicant per appliance model-application at the time of registration.
- **Labelling fee** that is to be deposited by the applicant at the end of financial year. This is to be submitted for every labelled appliance unit. Here, it is taken to be an average fee, which shall be constant for all three appliances, i.e. 5 to 7 MVR.
- **Penalty per appliance (if any)** as collected by the MCS or MEA at the time of customs clearance.

## *2.6. Case study: Cost of implementing EE labelling programme and options for cost recovery*

This case study estimates the cost of implementing and maintaining the EE labelling programme in FY 2020-2021, where the programme has been introduced in FY 2019-2020.



## Resource cost calculation

Based upon Section 2.1, the resource cost can be calculated as follows:

Resource Cost Calculation								
Sr. No.	Designation of the resource	Team	No. of posts	Initial salary per annum to the resource (MVR)	Annual increment (%)	Base year	Current year	Total cost incurred (MVR) for FY 19-20
1	Programme Manager	Technical	1	350000	8.00	2018	2020	378000
2	Programme Officer/ Application Manager	Technical	2	180000	8.00	2018	2020	583200
3	Surveillance officer	Technical	1	180000	8.00	2018	2020	194400
4	Awareness and outreach expert	Technical	2	135000	8.00	2018	2020	291600
5	IT Specialist/ Database Manager	Support	1	115000	8.00	2018	2020	124200
6	Other clerical resources	Support	2	80000	8.00	2018	2020	172800
Net resource cost incurred to the organization								.....

## IT services cost calculation

Based upon Section 2.2, the resource cost can be calculated as follows:

IT Service Cost Calculation				
Sr. No.	IT services provided	Net cost incurred per annum for the IT service (2019)	YoY Inflation rate in Maldives in FY 2019-2020	Net cost incurred per annum for the IT service FY 20-21
1	Recording of approval/ rejection of label	10000	1.8	10180
2	Communication with applicants/ stakeholders			
3	Surveillance record			
4	Awareness/outreach application			
5	Public portal maintenance			
6	Mobile app management			
Net IT services cost incurred				.....

## Surveillance cost calculation

Based upon Section 2.3, the resource cost can be calculated as follows:

Inspection Cost Calculation			
Sr. No.	Surveillance cost category	Type of expense incurred	Cost incurred (MVR)
1	Inspection Cost	Cost of transportation per location	500.000
2	Inspection Cost	Inspection through digital devices	500.000
3	Inspection Cost	Inspection on hard copy (if any)	100.000
Total no. of locations covered per annum			50
Inspection cost incurred			.....

Verification Cost Calculation			
Sr. No.	Surveillance cost category	Type of expense incurred	Cost incurred
1	Verification/ Testing Cost	Cost of AC sample tested	
2	Verification/ Testing Cost	Cost of refrigerator sample tested	
3	Verification/ Testing Cost	Cost of samples tested	
4	Verification/ Testing Cost	Sample transportation cost per AC	
5	Verification/ Testing Cost	Sample transportation cost per refrigerator	
6	Verification/ Testing Cost	Sample transportation cost per washing machine	
10	Verification/ Testing Cost	Cost of analysis of result per AC	
11	Verification/ Testing Cost	Cost of analysis of result per refrigerator	
12	Verification/ Testing Cost	Cost of analysis of result per washing machine	
Total no. of AC samples			50
Total no. of refrigerator samples			50
Total no. of washing machine samples			50
Verification testing cost incurred			(Cost of sample + Transport cost + Analysis cost) * Total no. of samples = <b>α</b>

**ILLUSTRATIVE**

## Outreach cost calculation

Based upon Section 2.4, the resource cost can be calculated as follows:

Outreach Cost Calculation					
Sr. No.	Category of outreach	Type of outreach	Frequency of outreach (Average occurrence per year)	Average cost per occurrence (MVR)	Cost incurred per outreach medium (MVR)
1	Print	Newspaper article/ advertisement	100	500000	3000000
2	Print	Magazine	20	500	10000
3	Print	Brochures	100	100	10000
4	Print	Leaflets	600	100	60000
5	Audio/ Visual	Posters and billboards	100	500	50000
6	Audio/ Visual	Radio advertisements	300		15000
7	Audio/ Visual	TV advertisements	50	200	10000
8	Audio/ Visual	Documentaries	2	5000	10000
9	Website	Website	1	1000	1000
10	Mobile app	Mobile app	1	1000	1000
Net outreach cost to the organization					.....

### Cost recovery

Based upon [Section 2.5](#), the resource cost can be calculated as follows:

Cost Recovery						
Sr. No.	Type of fee required to be deposited	Fee collected by	Category of fee deposited	Value of fee deposited per appliance/ per applicant	Total units	Net fee deposited
1	Security deposit	MEA	Per-Applicant	20000.000	100000	20000
2	Application fee	MEA	Per-Appliance	100.000	100000	10000000
3	Labelling fee	MEA	Per-Appliance	7.000	100000	700000
4	Penalty per appliance (if any)	MCS	Per-Appliance	2000.000	1000	2000000
5	Penalty per applicant (if any)	MCS	Per-Applicant	2000.000	5	2000
Net fee deposited						.....

## Net cost estimation

The net cost estimation can be shown as follows:

Final Cost	
Total resource cost for the organization	
	+
Total IT services cost to the organization	
	+
Total surveillance cost to the organization	
	+
Total outreach cost to the organization	
	-
Total cost recovery to the organization	
	=
Net cost incurred by the organization	

### 2.7. Key information needed for arriving at tentative cost for the programme

- No. of positions and respective cost /salary to be considered for each expert
- Should the cost for all of the minimum no. of resources required for the programme shall be considered from the beginning of the implementation OR should the hiring be considered in between the financial year
- Yearly increment for the resources
- Will the increment be same for all the designations or will it be different for different designations
- Number of inspections are to be considered in a year
- Provision of allocating a budget for hiring a third party for outsourcing some of work for MV&E
- Frequency of the inspection by the third party/MEA
- How shall the third party be selected for the inspection
- Assumption for the average sample cost
- Number of samples should be considered for the verification testing
- What shall be the level of confidence for the sampling design
- Assumption for the transportation cost for sample testing and inspection
- Quotations from international test agencies for verification testing of products (air conditioner, washing machine and refrigerator)
- Management and office expenses

## 3. Implementation plan

### 3.1. Key activities for implementation plan

The implementation plan broadly covers following major steps:

1. Development of institutional structure for implementation of S&L programme and capacity building of stakeholders
2. Launch of S&L programme
3. Implement Monitoring Verification & Enforcement (MV&E) protocols

A brief explanation is given on these steps & activities:

*Table 2: Key activities for implementation plan*

S. No.	S&L major steps & sub activities	Role of consultant / Donors/partners	Role of MEA	OUTPUT
1	Development of institutional structure for implementation of S&L programme and capacity building of stakeholders			
a	Building adequate capacity within MEA for implementation of all elements within the S&L programme as described in the earlier chapters of this document	Support	Lead	<ul style="list-style-type: none"> <li>• MEA is equipped with facilities to implement the programme</li> <li>• Capacity of stakeholders built to execute program</li> </ul>
b	Training and exposure to international practice for implementation (covering minute details of each element within the programme)	Implement / support	Guide	
c	Capacity building cum training program for importers, customs, local government agencies and other stakeholders	Implement / support	Guide	
2	Launch of S&L Program for the equipment			
a	Announcement for launch of efficiency standards and labelling regulation for air conditioner, refrigerator and washing machine in voluntary phase and defining the timeline for launch of mandatory regime	Support	Lead	<ul style="list-style-type: none"> <li>• Standard and labeling program for appliances launched</li> <li>• Communication plan developed, conceptual design of material, upgrade of website.</li> </ul>
b	Designing of communication campaign & outreach plan	Implement	Guide	
c	Launch awareness communications program	Support	Lead	
3	Implement Monitoring Verification & Enforcement (MV&E) protocols			

	a	Assess the requirement for implementation of monitoring verification & enforcement guidelines	Already completed	Lead	<ul style="list-style-type: none"> <li>Roles and responsibilities clearly defined</li> <li>Label inspection and verification testing protocol demonstrated to ensure compliance of labelling programme</li> </ul>
	b	Implement label inspection measures	Implement /support	Lead	
	c	Develop verification testing protocol to evaluate compliance of energy consumption with respect to labeling criteria and conduct verification testing	Implement /support	Lead	
4		Impact assessment			
	a	Development impact assessment methodology	Develop	Guide	<ul style="list-style-type: none"> <li>An impact assessment methodology for the programme is developed in line with the procedures mentioned in task 5</li> <li>Conduct impact assessment for actual data</li> </ul>
	b	Conduct impact assessment	Implement /support	Lead	
* The above plan is conceptual; it has not been approved by management and is subject to change accordingly.					

### 3.2. Brief description on activities under implementation plan

#### 3.2.1. Development of institutional structure for implementation of S&L programme and capacity building of stakeholders

The MEA has already started creating the infrastructure for implementation of S&L programme. The authority is likely to undertake various measures as outlined in this report in coming few months to be able to build sufficient capacity for seamless implementation of the programme.

A comprehensive training and capacity building of entire stakeholder group associated with design & implementation of S&L program is essential not only to introduce successful behavior change interventions, but also to maximize participation & compliance in the programme.

The S&L programme for domestic appliances will be launched in the Maldives for the first time and based on the discussion with stakeholders it is observed that understanding on S&L aspects need bolstering to facilitate effective implementation of energy labeling programme. Typically, a combination of technical and financial assistance is helpful to develop a proper programme with long term viability and to fully realize its benefits.

The activity involves assessment of training needs at Maldives in consultation with MEA and ME. A training strategy shall also be developed to build the capacity of MEA staff and other stakeholders towards international best practices, if required. Training sessions shall be held for various stakeholders of the program such as importers, Customs Service and other ministries. The stakeholder groups have to be technically and academically supported so that they remain motivated towards expansion of S&L programme.

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### *3.2.2. Launch of S&L programme*

Once energy standards are set and the institutional facilities are marked, the MEA shall proceed for launching the S&L programme. Generally, the S&L program is initially launched with voluntary labelling process. The introduction of the voluntary labelling programme for the equipment is accompanied by an outreach campaign to provide information to the consumers about the labelling programme and the benefits of this programme to the whole society. The market dynamics of the equipment is tracked with a view to assess the penetration of the labelled products in the market. Once the programme gains maturity, the introduction for mandatory labelling is considered.

The MEA along with key implementing partners and stakeholders shall evaluate the need for voluntary and/or mandatory labelling and accordingly announce regulation (s) for labelling of equipment. The launch of program shall be publicized and accompanied with an outreach plan to spread awareness at large scale. For easy access, a web portal shall be created. The portal shall be updated regularly with new features such as registration of importer / trader, generation of approval letter for license, registration for new models etc. (as applicable). The features shall be regularly updated to improve service quality and to ensure that the portal become a single point interaction between applicant, traders and MEA.

### *3.2.3. Monitoring Verification & Enforcement (MV&E) protocols*

Monitoring is a continuous process involving collection and analysis of data related to program performance parameters to give an accurate picture of conformance. It provides the opportunity to identify implementation issues and improve the performance of program implementation, as well as providing data for program evaluation.

Verification is the measurement process where independent third parties confirm the efficiencies claimed by suppliers (manufacturers, importer and/or retailers).

Enforcement is the action taken by program administrators (MEA) against suppliers of noncompliant equipment, as a result of finding fault through either monitoring or verification.

There are various potential violations and/or non-conformance issues that may emerge while real-time implementation of S&L programme. These are explained in the report for task 4 submitted to MEA.

Unless there is a means of checking the accuracy of energy label parameters or minimum energy performance levels, there can only be limited enforcement of energy efficiency legislation. As an integral part of the overall energy efficiency programs, monitoring and verification measures energy efficiency actions, assesses the relevant impact of individual actions, and holds entities responsible for their actions.

The activity involves conduct of label inspection and verification testing as per the programmatic framework.

### *3.2.4. Impact assessment*

Impact assessment involves evaluation of the progress of S&L programme post launch and identifying the areas for improvement.

### 3.3. Timeline (tentative)

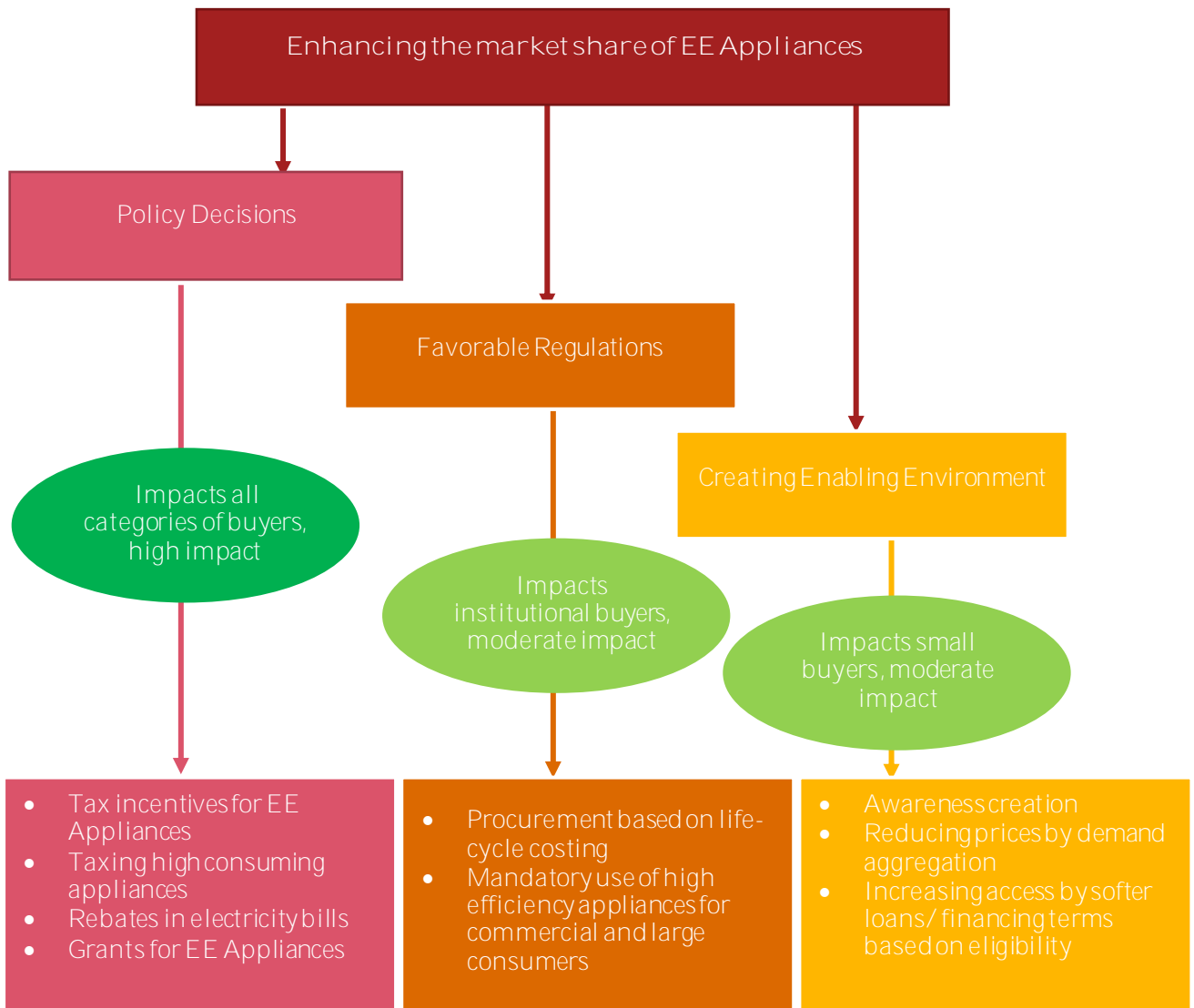
S. No.	S&L major steps & subactivities	Timeline (January 2020 to August 2021)																			
		2020												2021							
		M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M1	M2	M3	M4	M5	M6	M7	M8
1	Institutional infrastructure and capacity building	█	█	█	█																
a	Building adequate capacity within MEA for implementation of all elements within the S&L programme as described in the earlier chapters of this document	█	█																		
b	Training and exposure to international practice for implementation (covering minute details of each element within the programme)		█	█																	
c	Capacity building cum training program for importers, customs, local government agencies and other stakeholders			█	█	█	█														
2	Launch of S&L Program for equipment			█	█	█	█	█	█	█	█										
a	Announcement for launch of efficiency standards and labelling regulation for air conditioner, refrigerator and washing machine in voluntary phase and defining the timeline for launch of mandatory regime					█															
b	Designing of communication campaign & outreach plan			█	█																
c	Launch awareness communications program					█	█	█	█	█	█										
3	Monitoring Verification & Enforcement protocols											█	█	█	█	█	█	█	█	█	
a	Assess the requirement for implementation of monitoring verification & enforcement guidelines											█									





access by softer financing/ loan terms, reducing the prices by demand aggregation, undertaking replacement programs, etc.

S&L programs provide a clear-cut eligibility decision framework for these support mechanisms based on EE tier of the appliances. These supporting measures for implementation of S&L program are illustrated next.



Based on above analysis, the following support mechanism is recommended in the Maldivian context:

### Tax incentives

Being an import driven market, tax incentives may be provided in the form of moderated import duties based on EE tier of the appliances. The following structure is proposed, subject to approval of ME and other relevant stakeholders.

EE Level	Import Duty exemption
Level 5 (Most energy efficient, highest upfront cost)	100%
Level 3 and Level 4 (moderate efficient, high upfront cost)	50%
Level 1, Level 2 and non-labeled (least efficient, least cost)	0%

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## Grants for EE appliances

Grants for EE appliances may be provided in form of up-front subsidy to buyers, subsidizing the cost of finance for EE appliances as an enabling measure, incentivizing local testing, etc.

## Procurement based on life-cycle costing

Procurement of electricity consuming appliances based on their life-cycle costing, including energy cost, is often used regulations by several governments, the key examples being EU, USA, India, etc. The measure works best in case of public procurement wherein procurer behavior and procurement process can be controlled using suitable regulatory amendments in public finance regulations.

## Mandating high efficiency appliances

Mandatory use of high efficiency (say Level 3 and above) appliances may be prescribed by the government in licensed sectors such as large commercial spaces, hotels, guesthouses, restaurants, airports, etc.

## Awareness creation

Awareness creation at the point of sale, call for action and demonstrating the business case using touch-and-feel aides are the proven mechanisms for enhancing awareness levels of small buyers and creating a pull effect in the market for EE appliances. Appropriate M&E mechanisms may be put in place for monitoring the impact of communication activities.

## Increased access by financing mechanisms

Suitable business models backed by government support/ grant results in offsetting of initial increment cost for EE appliances. As a result, the buyer behavior may be influenced towards buying more efficient appliances provided there is only a little incremental effect on the net out-**go per month from the buyer's pocket.**