



Ministry of Environment
and Energy

TECHNICAL ANALYSIS OF MARKET TO DEVELOP ENERGY EFFICIENCY LABELS IN MALDIVES



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





Ministry of Environment and
Energy

Strengthening Low Carbon
Energy Island Strategies (LCEI)
Project



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1. INTRODUCTION

The main objective of this report is to present the analysis of data gathered for the electrical appliance market study in the Maldives. This analysis is commissioned by the “Strengthening Low Carbon Energy Island Strategies Project” (LCEI). The LCEI is implemented by the Ministry of Environment and Energy with support from United Nations Environment Programme (UNEP). The Government of the Maldives and the Global Environment Facility (GEF) provided the funds for LCEI Project.

The information gathered in this report is for use by the Ministry of Environment and Energy to inform and support government decision making on the most suitable energy efficiency labels and standards for the Maldives. Maldives Energy Policy and Strategy (2016) calls to increase energy efficiency in the supply and demand side by implementing energy labeling program for major energy consuming appliances. This analysis will be used to determine an appropriate labeling plan for high energy use appliances to help consumers identify and base their purchase decisions on lifetime appliances costs as opposed to only upfront costs. This analysis will also be used to adopt minimum energy efficiency standards for the Maldives.

The scope of data for this report is for the following electrical appliances imported to the Maldives: (1) air conditioners; (2) refrigerators and freezers; (3) washing machines; (4) televisions; (5) lights; (6) electric ovens; (7) electric water heaters; (8) water pumps; and (9) electric fans.

This report attempts to shed light on the monetary value of each appliance type; the quantity of appliances imported; the key importers; the brands sold; the countries of manufacture; the countries of shipping origin; the appliance types; the annual energy consumption and the forecasted trends for each appliance. 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 labeling and energy efficiency standards in the Maldives.

In order to complete this report our researchers analyzed a large data set of 10 years of Maldives Customs Data. The retailer survey completed to shed light on sales figures and models sold was simple and straightforward with some retailers while other retailers were reluctant to provide sales data.

This study provides a foundation for further work. The study provides information to assess the appliance selection to achieve a significant reduction on energy consumption and gear the market towards energy efficiency appliances.

2. METHODOLOGY

For this report, research was undertaken using quantitative methods, which included analysis of available data from Maldives Customs Service (MCS) and primary data collected through retailer surveys.

MCS keeps a database of all imports to the Maldives. All the imports are identified against an international harmonized system of codes established by the World Customs Organization. It was identified that some of the parameters needed for this study such as Make/Brand, Model Number, Capacity, Power Rating, and Year of Manufacture are not available in the MCS database. The approach was hence changed to attain the full information in the database related to electrical and electronic appliances. The relevant HS codes related to this analysis were identified; and the appliances recoded under these HS codes were assessed for the required information. The HS codes which are included in this analysis are given in Annex A.

A number of data cleaning and filtering processes were employed to ensure the analysis were useful for the purpose of this study. A small amount of data not significantly affecting the results were removed due to a lack of reasonableness. One example includes large quantities of air conditioners with a value of about MVR20 each. This is most likely to be errors in entering the data by customs and point to a possible lack of system controls to alert when amounts outside a reasonable range has been keyed in.

It should be noted that MCS database allows multiple forms of data entry for the fields “Country of Manufacture” and “Country of Origin” and hence duplicate country codes appear multiple times for several countries. For example, the database includes UAE, Emirates and United Arab Emirates as three different countries. Similarly, USA, America and United States and United States of America are separately included. There are more countries of this nature. This kind of errors does reduce confidence in the accuracy of data entry on a general level as well as the systems controls employed by the MCS.

For this study, import data sets for the last 10 years were analysed and compared it with the most recent year 2016 to evaluate if the 10 year analysis showed any significant differences from 2016. Hence, the report is composed with a focus on year 2016 as this approach is more useful for the purpose of the study than a general analysis of the 10 years. Variables such as importers and dominant countries and even dominant appliances from older years are not the most relevant for current times. Findings of the 10 year data set is presented in the Annex to the report.

For the retailer survey, top importers of 2016 of the selected appliances were chosen. The survey was conducted over a period of two weeks by enumerators who visited the shops and collected the information on site. A total of 17 retailer shops were interviewed for this project. The questionnaire used for the survey is attached in Annex L.

The retailers participated in this survey are: State Trading Organization (STO); Red Wave; Efficient Electronics; Reefside; AJE Emporium; Night Owl; Sonee Hardware; Veligaa Hardware; D Blue Marine; Monalals; Tech Mart; Agora; AH Brothers; Refcool; Lecute Electronics; Asters; and Steel Hardware.

Due to commercial sensitivity of detailed sales data, the retailers were not willing to provide the annual sales data for the appliances, hence imports data for 2016 provided by MCS is used as a substitute for sales number. Since, the imports dataset from MCS does not have sufficient details of the brand and model number of the appliance, annual sales data is only provided by appliance type.

All individual importers who imported any of the selected codes during the last 10 years were screened by their importer name. Any importer that is reasonably identifiable by their provided name as one who does not import for the purpose of resale is tagged as non-retailer imports. Some of the examples who are tagged as non-retailer include government departments, NGOs, tourist resorts, major projects and large companies not operating in retail sector such as Dhiraagu. The isolation of import data for retail sector alone is very valuable to observe the trends without the influence of large-scale imports of non-retail sector, which can skew the import pattern due to large one-off projects.

3. KEY FINDINGS

The key findings for this section are based on data from 2016, as these are the most accurate and recent findings of this study. Results based on the analysis of past 10 years data are presented in the section for each appliance.

3.1. Monetary Value

The top five electrical appliance imports in 2016 in terms of CIF value are;

1. Air conditioners
2. Televisions
3. Water pumps
4. Refrigerators
5. Fans

Of appliances imported air conditioners have highest value. Figure 3.0 below shows the CIF values of all the 9 appliances imported in 2016.

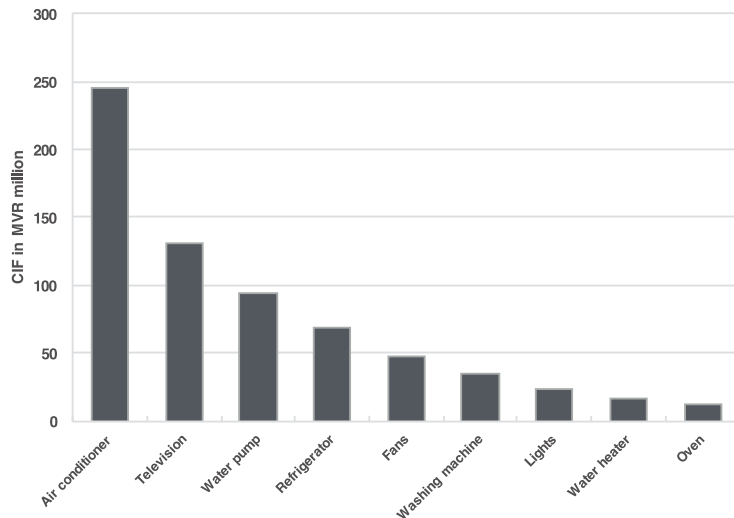


Figure 3.0 Monetary value of imports – 2016

The data analysis from 2006 to 2016 also showed similar findings as to that of 2016. Appliances with the highest CIF values are Air Conditioner, Television, Water

Pumps, Refrigerators and Fans respectively. The CIF value of each appliance is discussed under the section for each appliance.

3.2. Number of Units Imported

The top five electrical appliance imports in 2016 in number of units are;

1. Lights (927,261)
2. Fans (117,463)
3. Air conditioners (45,446)
4. Water pumps (44,547)
5. Televisions (26,664)

Of appliances imported, lights are the top most in quantity. Figure 3.1 below shows the quantity of appliances imported in 2016.

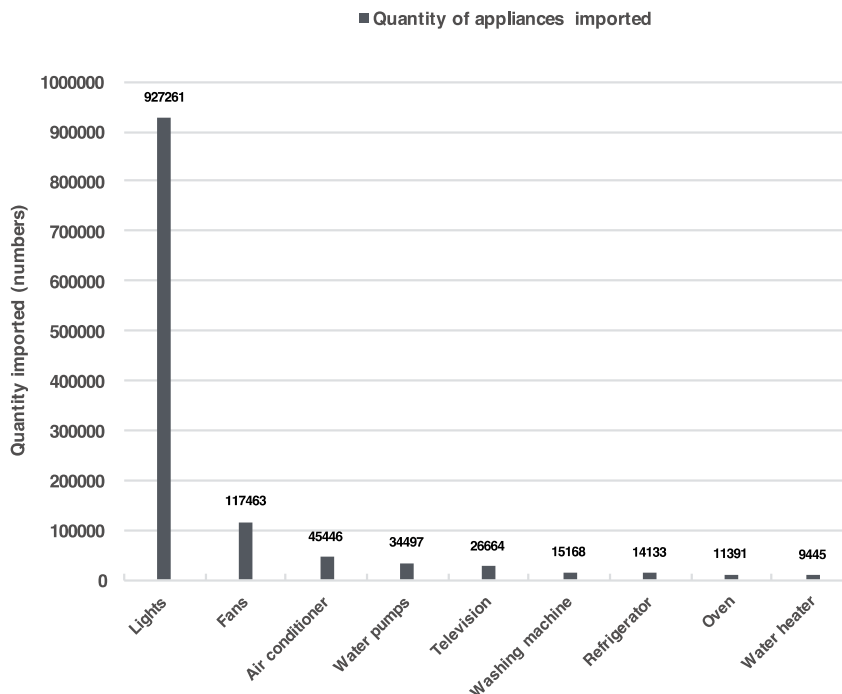


Figure 3.1 Number of units imported 2016

Data analyzed for the ten years from 2006 to 2016 also revealed similar results. The top 5 appliances imported over the last 10 years are lights, fans, water pumps, Air Conditioners and Televisions respectively. The number imported for each appliance

for each year is presented in the section for each appliance.

3.3. COUNTRIES OF MANUFACTURE

As seen in Table 3.0 below, majority of the appliances imported in 2016 are manufactured in China. Other main countries include Thailand, Malaysia and India.

Data analysed for top countries of manufacture for each appliance will be presented under each appliances' section.

3.4. COUNTRIES OF SHIPPING

As seen in Table 3.1 Singapore, China, and UAE are the major countries of shipping for the appliances imported to the Maldives in 2016. Other main countries of shipping include Hong Kong, Thailand, Malaysia and India.

Data analysed for top countries of manufacture for each appliance will be presented under each appliances' section.

IMPORTS BY COUNTRY OF MANUFACTURE										
AC	Refrigerator	Washing Machine	TV	Ovens	Water Heaters	Water Pumps	Fans	Lights		
China (46%)	China (36%)	China (58%)	China (60%)	China (83%)	China (37%)	China (10%)	China (40%)	China (55%)		
						Thailand (4%)				
						South Korea (7%)				
	Thailand (11%)				Thailand (37%)	Thailand (16%)			Others	India (38%)
	Malaysia (32%)									
India (8%)	Thailand (4%)	Malaysia (13%)	Singapore (10%)	Thailand (26%)						
Singapore (7%)	India (5%)	Others	Others	Others	Others					
Others	Others	Others	Others	Others	Others					

Table 3.0 Manufacturing countries for appliances imported in 2016

IMPORTS BY COUNTRY OF SHIPPING								
AC	Refrigerator	Washing Machine	TV	Ovens	Water Heaters	Water Pumps	Fans	Lights
China (20%)	China (17%)	China (44%)	China (18%)	China (10%)	China (4%)	China (10%)	China (24%)	China (31%)
	Singapore (43%)		Singapore (49%)	Singapore (12%)	Singapore (40%)	Singapore (10%)		
Singapore (31%)		Singapore (22%)		UAE (72%)		UAE (20%)	UAE (10%)	Singapore (12%)
Hong Kong (16%)	UAE (17%)	UAE (19%)	UAE (12%)		UAE (20%)	Thailand (17%)	India (36%)	Singapore (24%)
Malaysia (12%)	Thailand (10%)	Others		Others		Thailand (7%)		Hong Kong (13%)
India (11%)	India (8%)		Others		Others	Malaysia (5%)	South Korea (9%)	Others
Others	Others	Others		Others		Others	Denmark (8%)	
								USA (5%)

Table 3.1 Shipping countries for appliances imported in 2016

3.5. ENERGY LABELS

During the market study several energy efficiency labels from country of origin were identified. This information however, is not retained in any importer or retailer documents or databases. Our findings show that these labels are currently not used by the seller as in the Maldives as a market tool in promoting the energy efficiency of the appliance.

An extensive internet research was conducted to determine the availability of energy efficiency labels in the countries of origin for the selected appliances. China, Thailand, Malaysia and India are the main countries where most of the electrical appliances studied for this report are manufactured. All four countries have their national energy efficiency label schemes. The following section will give an overview of the energy labels in each of these countries.

3.5.1. Malaysia’s Energy Label

Malaysia is the top manufacturer of ACs, TVs and refrigerators that are imported to the country. 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. All manufacturers and importers of the following products: television, refrigerator, domestic fan and air conditioner, must affix this Energy Efficiency Label onto the products before it can be sold to the customer. Figure 3.2 below shows the energy label of Malaysia.

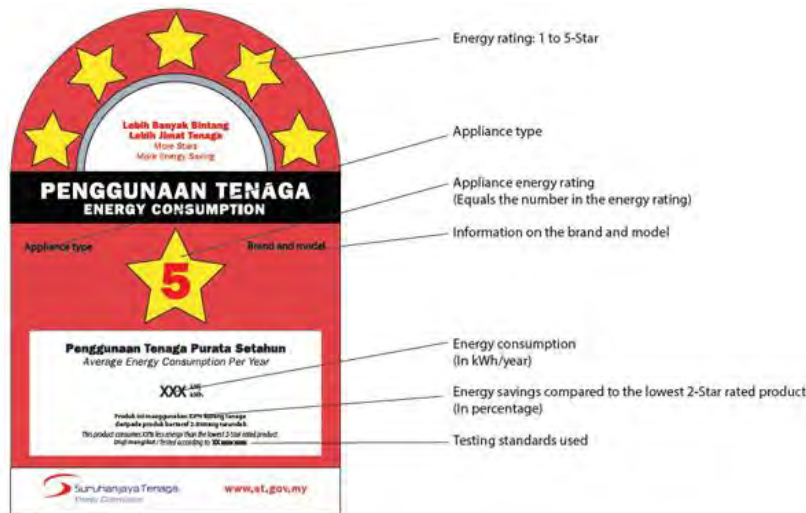


Figure 3.2 Malaysia’s Energy Label

As seen in the figure above, the energy label indicates the type of the appliance, information on brand and model, annual energy consumption and the energy savings compared to the lowest 2-star rated product in percentage.

3.5.2. Thailand's Energy Label

Thailand is also the top manufacturer of washing machines, TVs and refrigerators that are imported to the country. The energy label in Thailand covers refrigerators, freezer, and electric motors. The energy labeling scheme uses a number rating system, with 5 being the highest mark and given for the most energy efficient appliance. Figure 3.3 below shows the energy label of Thailand. The energy label indicates the type of the appliance, capacity, model number and annual electricity usage.



Figure 3.3 Thailand's Energy Label

3.5.3. China's Energy Label

China Energy Label (CEL) is an energy consumption label for products in China, similar to the European Union Energy Label. Among the CEL mandatory products

are: motors, air conditioners, refrigerators, washing machines, gas kettles, water kettles, photocopiers, air compressors, flat screen televisions, fluorescent tubes. Their energy label features a number grading where the grade 1 is for most energy saving. The label also provides other information about the appliance such as, product manufacturer, model number, energy consumption level, energy efficiency coefficient and input power. See figure 3.4 below.

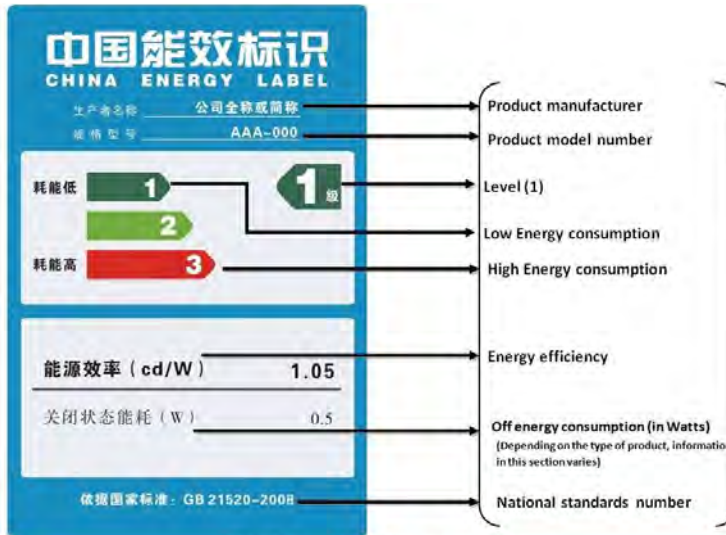


Figure 3.4 China Energy Label (CEL)

3.5.4. Singapore’s Energy Label

Singapore is amongst top manufacturer of ACs, washing machines, TVs and refrigerators that are imported. Singapore uses a tick rating system where the number of ticks indicates the energy efficiency of the appliance. The highest number of ticks an appliance can obtain is 5. Other information provided in the label include, annual energy cost, annual energy consumption, type of appliance and capacity. The annual energy cost is computed based on typical appliance usage, energy consumption value and electricity cost. Figure 3.5 below shows the energy label used by Singapore.



Figure 3.5 Singapore's Energy Label

3.6. FUTURE TRENDS

Looking at the general trend of import of household appliances, there is a general upward trend for all the appliances. Hence it is likely that this upward trend will prevail in the future as well. The spikes in certain trends can be explained by factors such as construction boom and international events like football world cup. However, the general trend lines calculated for this study will be a more reliable measure for the purpose of this study.

To forecast trend for the next 10 years accurately, detailed information on future housing plans, income, and demographic trends is vital. However, since this data was not attainable during the time of this report, forecasts were calculated based on simple linear regression model. The confidence interval for future years increases significantly as a simple linear forecast is done using 10 years. The accuracy of the forecast is dependent on availability of historic data, a minimum of 30 data points is required to make a reasonable forecast using linear regression model. The forecasted quantity based on past 10 years data for each appliance from 2017 till 2026 is shown in Table 3.2 below.

FORECAST QUANTITY GROWTH FACTOR ('000s) - YEAR-ON-YEAR

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Air conditioners	561	668	775	882	988	1,095	1,202	1,309	1,416	1,523
Refrigerators	141	144	148	151	154	158	161	164	168	171
Washing machines	188	199	209	219	230	240	250	260	271	281
TV	243	252	260	269	277	286	294	302	311	319
Lights	9,887	10,157	10,427	10,696	10,966	11,236	11,505	11,775	12,045	12,314
Ovens	135	143	152	160	169	177	185	194	202	211
Water heaters	103	112	121	130	139	148	156	165	174	183
Water pumps	297	303	309	315	321	327	333	339	345	351
Fans	1,384	1,630	1,876	2,121	2,367	2,613	2,859	3,104	3,350	3,596

Table 3.2 Forecast quantity growth factor from 2017 to 2026

4. RECOMMENDATIONS

The stock of household appliances is an important indicator for energy efficiency improvement related decision making. In order to establish a good baseline of appliance stock it is necessary to conduct a household survey. It is recommended that MEE initiates a dialogue with National Bureau of Statistics (NBS) to add a module on electrical appliances used in households in the next National Population and Housing Census.

Since there is no manufacturing or assembling of electrical appliances in the Maldives, the annual increase to the stock of appliances can be determined through (MCS) import data. At the moment, the MCS does a very good job of maintaining imports data and makes them publicly available. It is recommended that MEE prepares a list of the parameters that importers shall provide to MCS for appliances that are regulated for energy labelling by MEE. The parameters required include: type and characteristic of appliance, brand name, model number, size/capacity, power rating, country of manufacture, city of manufacture, and country of shipping.

In order to determine the success of the energy efficiency labelling scheme, it is important to have accurate sales data by appliance model. This study showed that there are less than 15 main importers for each electrical appliance type and the same importers sell the items directly in their own shops. Hence, it is recommended that MEE make arrangements with Ministry of Economic Development to have a confidential data sharing agreement with importers of each regulated appliance for energy labelling in the Maldives.

The trends in real prices of all regulated household appliances for energy labelling will be an important indicator for policy improvement. It is recommended that MEE establish a database for time series price data of regulated household electrical appliances. The cost-effectiveness to consumers of purchasing newer and more efficient appliances can only be determined by tracking changes in real prices

customers have to pay.

Air-conditioners have the largest annual energy consumption among household electrical appliances. The main type of AC sold in the Maldives is split non-ducted wall mounted systems. With higher temperatures the demand for AC increases every year, particularly in the months of February and March. The rising temperatures coupled with increase in household income levels (HIES, 2014) is likely to increase demand for air-conditioners over the next ten years. The planned new housing construction in Hulhumale' estimated at about 25,000 new apartments is likely to lead to record high imports of AC in the next five years. It is estimated that the quantity of AC imported annually will be over 60,000 units by 2025. In this context, it is recommended that split system wall mounted refrigerative air conditioners for household use are regulated urgently with Minimum Energy Performance Standards (MEPS) and energy labelling in the Maldives.

Consumers are likely to make active choices in the selection of AC size, brand and model before purchase. Hence it is recommended that MEE introduce an easy to use smart phone application for customers to calculate and compare energy consumption in different models.

Since refrigerator-freezers are used 24 hours for 365 days a year by almost all households, offices, workplaces and shops, the financial savings and greenhouse gas reductions from energy labelling can be substantial. It is recommended that refrigerator-freezers above 60 L (those below 60 L are typically used for commercial purposes) be regulated with energy labelling and MEPS in the Maldives. Refrigerators of capacity below 60 L used in Maldives are mini bar type refrigerators which are generally used in resorts and guesthouses.

In the Maldives washing machines are of large size, used frequently and sometimes washed on partial loads or single items. Hence, there is significant scope for money saving and greenhouse gas reduction through both saving of water and energy. In this context, it is recommended that washing machines be regulated through both energy efficiency and water efficiency standards. The information on energy and water

efficiency can be provided to customers in a single label.

Televisions consume more energy than people perceive. The number of televisions, screen sizes and use hours are likely to increase in the Maldives and households make active choice decisions on the type, size, model and brand of televisions. In this context, it is recommended that televisions be regulated through energy efficiency labeling.

Individual lamps do not consume large quantities of electricity. However, the average Maldivian home has several lamps. These lamps are switched on and likely to be in use for 365 days a year for at least 6 hours every day. When aggregated, lighting accounts for a significant proportion of the average household's electricity use in the Maldives, especially for the low-income households. Lighting also accounts for a high proportion of end use electricity for commercial purposes. This study also revealed that consumers face the risk of purchasing inferior LED products at a high price. This could negatively impact on consumer confidence and uptake of the most energy efficient lighting technology available in the market. In this context, it is recommended that lights be regulated through energy efficiency labelling and MEPS.

With the sheer number of lights sold and the different types of lamps in market, it is suggested that the MEE establish a specialist unit and a technical committee for lighting. The main objective of this unit and technical committee will be to regulate the import of lights to ensure environmentally appropriate, energy efficient, quality lights get imported to country. The committee will help set national standards relating to the lights, and promote the use of electrically safe and energy efficient lighting. The unit and committee will work with building industry to encourage good lighting design and conduct education and training.

Although the Maldives has an existing high stock of household electrical ovens and the stock is likely to increase in the future, the use of electrical ovens is not likely to increase. Ovens are likely to be limited to high use in the month of Ramadan only. The popularity of eating out is on an upward trend and this trend is fast catching up in the small islands as well. Electrical ovens do use a lot of energy and different

brands of oven use more than others. However, ovens are presently a difficult area to regulate for energy efficiency because products are very region specific and product use varies greatly among households. In this context, it is recommended that ovens be considered for energy efficiency regulation in a later stage.

Water heaters in the market are instantaneous electric heaters that produce hot water on demand. Such heaters have very high energy consumption levels for the short use duration. There are better technologies available for heating water for household use and it is recommended that MEE incentivise alternative technologies first.

Water pumps and fans rely on motors and there are ISO standards for the development of motors. There are negligible differences in the energy consumption of fans in the market. Hence, it is recommended that water pumps and fans be considered for regulation in a later stage.

5. AIR CONDITIONERS

5.1. Monetary Value of Imports

In 2016, MVR 245 million worth air conditioners were imported. Value of air conditioners imported has doubled in five years. CIF value of air conditioner imports shows a sharp increase since 2010. The CIF value of imports more than doubled from MVR 113 million in 2012 to 245 million in 2016.

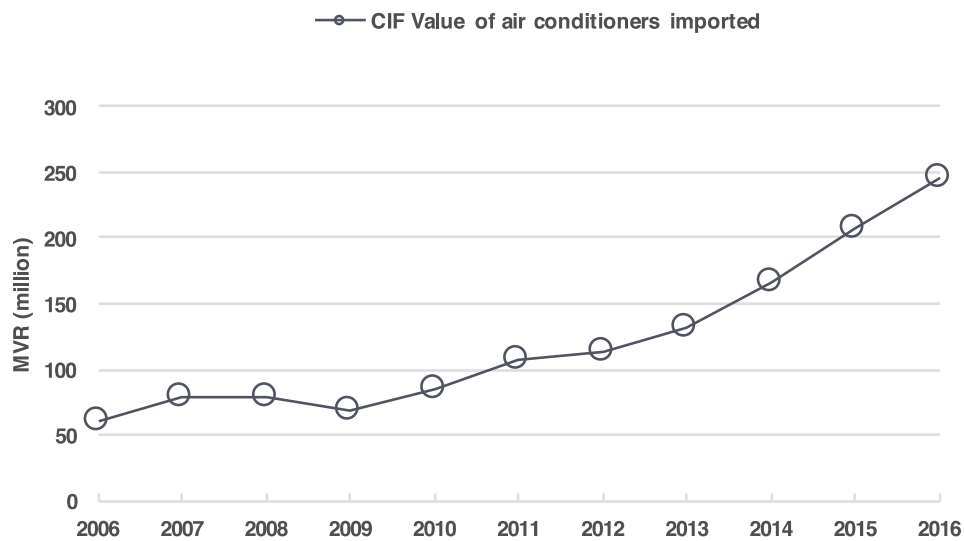


Figure 5.0 CIF Value of air conditioners in MVR (million) imported from 2006-2016

5.2. Number of Units Imported

Number of air conditioners imported quadrupled in 10 years. The number of units of air conditioners imported to the Maldives is showing a significant increase. The number of units imported has doubled from 20,139 in 2013 to 45,446 in 2016.

Quantity of air conditioners imported in the past ten years has increased from 10,981 to 45,446

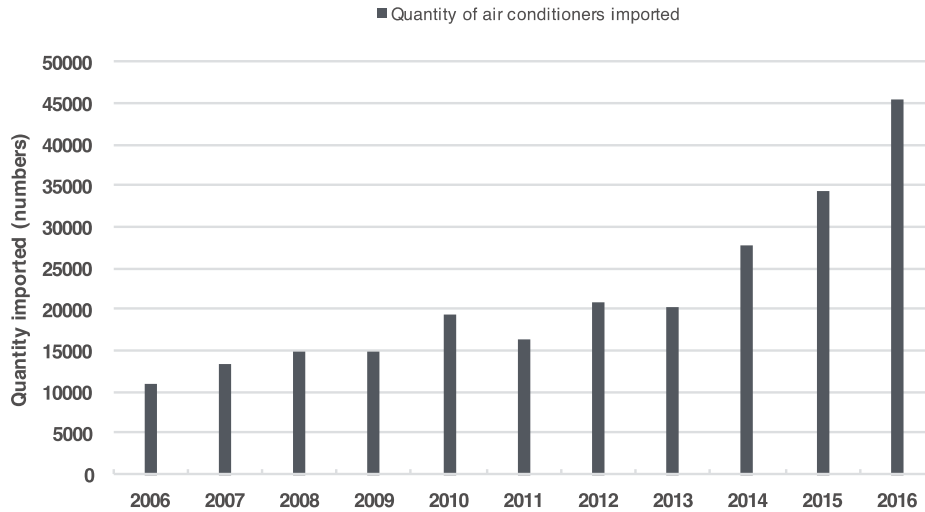


Figure 5.1 Quantity of air conditioners imported from 2006-2016

5.3. Major Importers

Over the past 10 years, STO has been the lead importer of ACs, taking lead in 7 years. Top importers in the rest of the years include RefCool and AJE Emporium. Other importers that are consistent over the 10 years include Bright Brothers/Agora, Lintel Investments and Monalals. It must be noted that in some years, a large quantity of ACs were also imported by companies developing resorts and apartment buildings.

In 2016, ten companies imported 74% of AC in 2016. RefCool is the leading importer of AC and accounted for 18% of imports in 2016. STO (17%), Lintel Investments (10%), Eco Cool (8%) and AJ Emporium (7%) are the other main importers of AC. Figure 5.2 below shows the top importers of AC in 2016. Top importers of AC for the last 10 years are presented in Annex C.

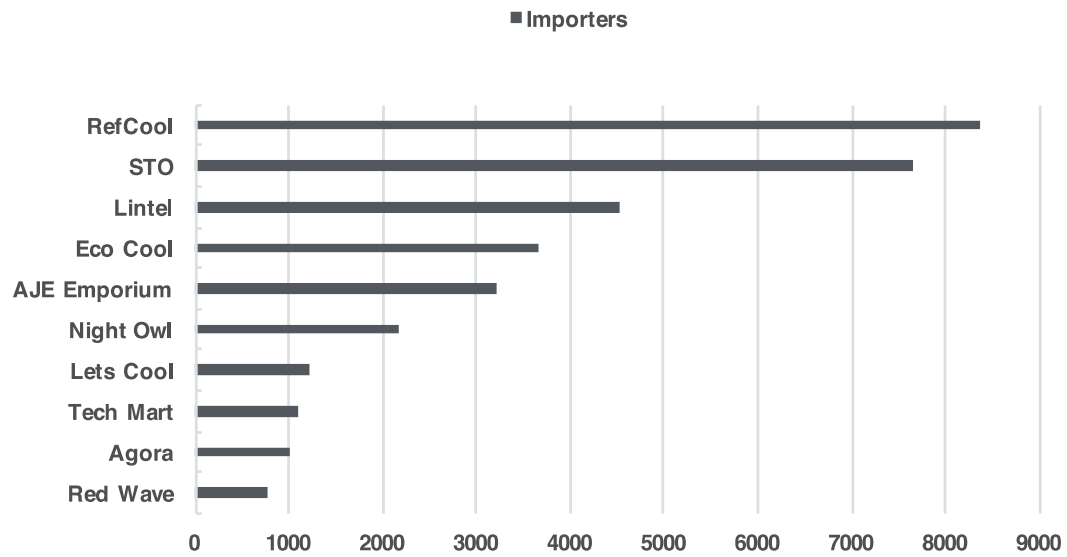


Figure 5.2 Major importers of AC in 2016

5.4. Brands in the Market

The brands of AC sold by the top importers of 2016 include Hitachi, LG, Panasonic, Gree, Blue Star, Midea, Daikin, Galanz, Voltas, Super General, Sharp, Mitsubishi, Skyworths, and Nikai. Table 5.0 below shows the brands of AC in imported by the top importers in 2016.

Brand	Importer
Gree	Ref Cool
Hitachi	STO
Galanz	Ref Cool
Panasonic	AJE Emporium, Lintel
Super General	AJE Emporium

Midea	Agora
LG	AJE Emporium, Eco Cool
Daikin	Agora
<i>Blue Star</i>	Eco Cool
Mitsubishi	Eco Cool

Table 5.0 Top brands and importers of AC

5.5. Imports by Country of Manufacture

Results of past 10 years data showed that, majority of the air conditioners imported to the Maldives were manufactured in Malaysia. From years 2008 to 2015, Malaysia is the top country of origin. In 2007, most of the ACs imported were manufactured in Singapore and in 2016, most of the air conditioners imported to the Maldives were manufactured in China (46%) and Malaysia (32%). About 11% of air conditioners imported were manufactured in Thailand. As seen from Figure 5.3 below, import quantity of ACs that are manufactured in China boomed from 2014 onwards.

Gree, Midea, Galanz, and Super General AC are manufactured in China. Panasonic and Hitachi brand are manufactured in Malaysia. LG brand AC are manufactured in Thailand, while Blue Star and Voltas are manufactured in India.

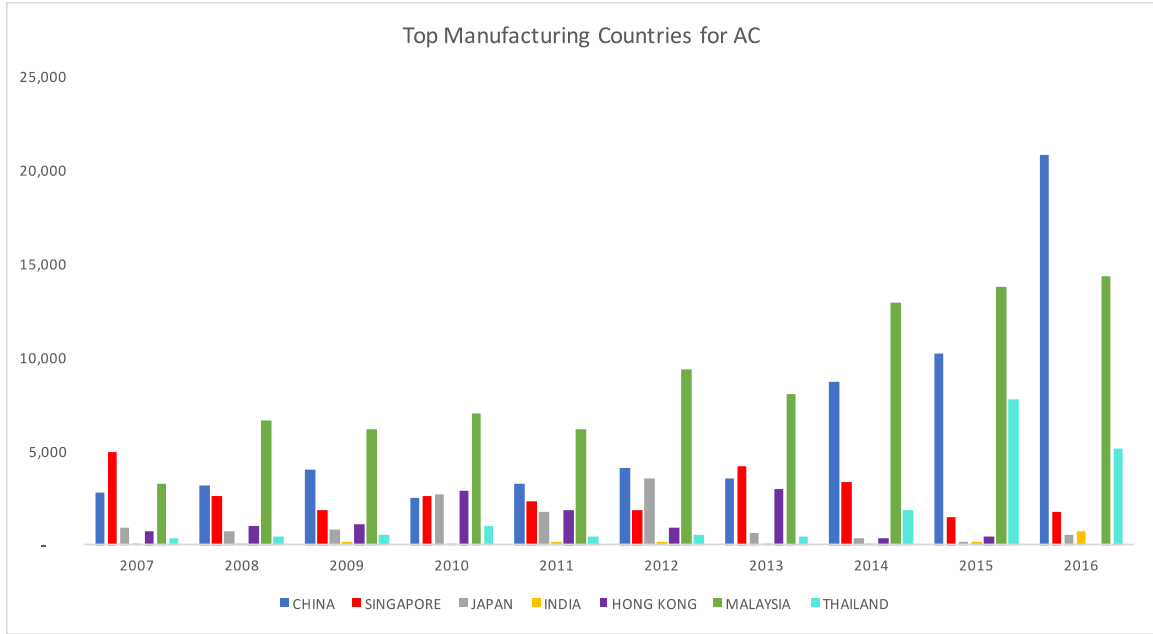


Figure 5.3 Main countries of manufacture origin for AC

5.6. Imports by Country of Shipping

Over the span of 2006 to 2016, most number of ACs were shipped from Singapore.

The main country of shipping for air conditioners imported to the Maldives in 2016 was also Singapore (31%), followed by China (20%), Hong Kong (16%), Malaysia (12%) and India (11%). One out of every three air conditioners imported to Maldives in 2016 was shipped from Singapore. See figure 5.4 below.

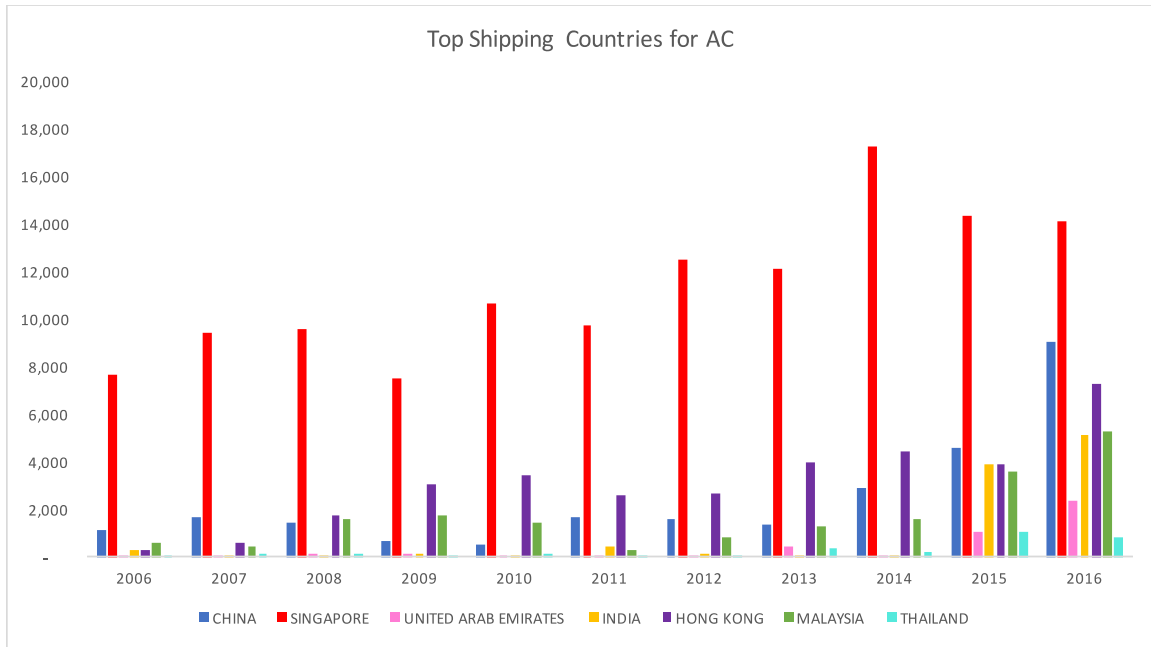


Figure 5.4 Main countries where AC is shipped from

5.7. Types of Air Conditioner

5.7.1. Wall mounted split system

The most common type of AC imported is wall mount split system that has an outdoor unit that houses the compressor and condenser, and an indoor unit that is commonly mounted on a wall.

5.7.2. Refrigerant Used

Refrigerant types of all AC were R410A. Almost 100% of AC are inverter models in which compressor is powered by a variable speed drive enabling compressor to run at a range of speeds from slow to fast to match output.

5.7.3. Five different sizes of Air Conditioners

The sizes of AC sold include 9,000 BTU, 10,000 BTU, 12,000 BTU, 18,000 BTU and 24,000 BTU. Most popular capacity is 9,000 BTU.

5.8. Energy Consumption

Actual annual energy consumption depends on factors such as room temperature, thermostat setting, insulation levels, number of windows, shading, orientation, and frequency of maintenance.

Among the models explored in the market, 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 9,000BTU air conditioner was Hitachi brand (RACSX10CD) and 10,000BTU air conditioner was Panasonic brand (CS-S10RKH). The annual energy consumption for different models range between a low of 865 and 1,845kWh.

For the 12,000 BTU models energy consumption range is between 865 and 1,215 kWh/annum. The air conditioner with 12,000BTU of energy consumption value 865kWh/annum was of Voltas brand (EU123VEY-CU123VE). The one with 1,215kWh/annum for the same capacity of air conditioner was model Hitachi brand (RACSX13CD). For the 18,000 BTU models the annual energy consumption range is from 1,845 and 2,005 kWh/annum. They are of the brand Hitachi and Blue Star respectively.

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

5.9. Quantity Forecasted

Annual air conditioner imports forecasted to be over 60,000 by 2025. Air-conditioners have the largest annual energy consumption among household electrical appliances. With higher temperatures and increase in household income the demand for air-conditioners will grow naturally over the next ten years. The planned new housing construction in Hulhumale' estimated at about 25,000 new apartments is likely to lead to record high imports in the next five years. It is estimated that the quantity of AC imported annually will be over 60,000 units by 2025.

In this context, it is recommended that split system wall mounted refrigerative air conditioners for household use are regulated with MEPS and energy labelling in the Maldives. Consumers are likely to make active choices in the selection of AC size, brand and model before purchase. Hence it is recommended that MEE introduce an easy to use application for customers to calculate and compare energy consumption in different models.

6. REFRIGERATORS

6.1. Monetary Value of Imports

In 2016, MVR 68.6 million worth refrigerators and freezers were imported. A steady increasing trend in CIF value is observed for refrigerators. CIF value of refrigerators imported shows a steady annual growth. There was a dip in CIF values in 2009, when imports were hit by global financial crisis.

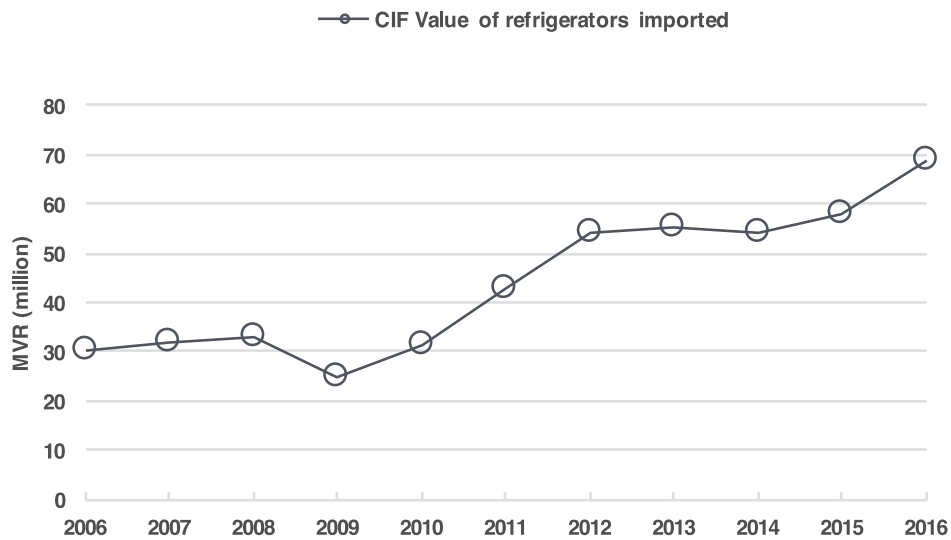


Figure 6.0 CIF value of refrigerators imported in MVR (million) from 2006-2016

6.2. Number of Units Imported

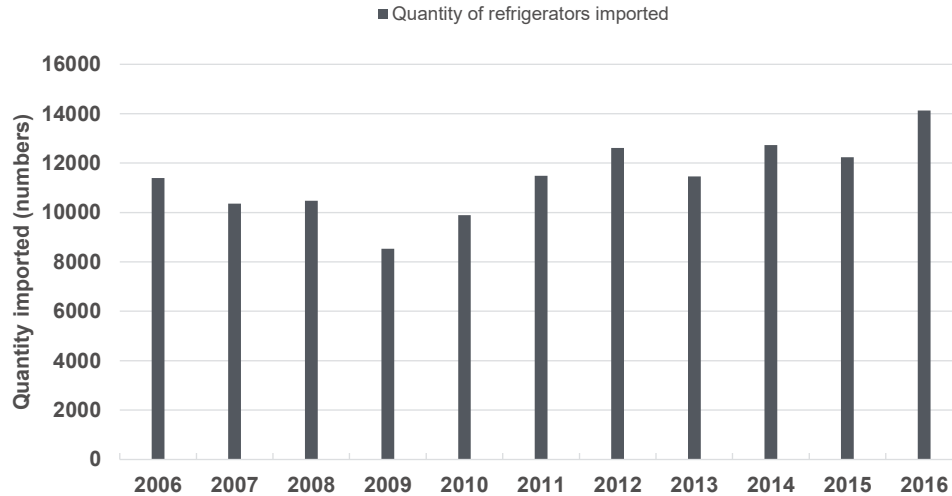


Figure 6.1 Quantity of refrigerators imported from 2006-2016

The number of units of refrigerators imported to the Maldives annually has remained steady at about 12,000 units. However, there was an increase of 1900 units in 2016 to 14,133 from 12,233 in 2015. Quantity of refrigerators imported over the past ten years increased from 11,391 in 2006 to 14,133 in 2016.

6.3. Major Importers

Over the past 10 years, STO has been the top importer of refrigerators to the Maldives, taking lead in every year except 2013. AJE was the top importer in 2013. Other top importers of refrigerator include, Monalals, Bharat Enterprises, Red Wave and Reefside

In 2016, seven companies imported 77% of refrigerators. STO is the leading importer of refrigerators and accounted for 22% of imports in 2016. AJE Emporium is the second largest importer (21%) followed by Red Wave (11%), Reef Side (9%), Night Owl (6%), Monalals (4%) and Efficient Electronics (3%). Figure 6.2 shows the top importer of AC in the year 2016. Top importers of refrigerators for the last 10 years are presented in Annex D.

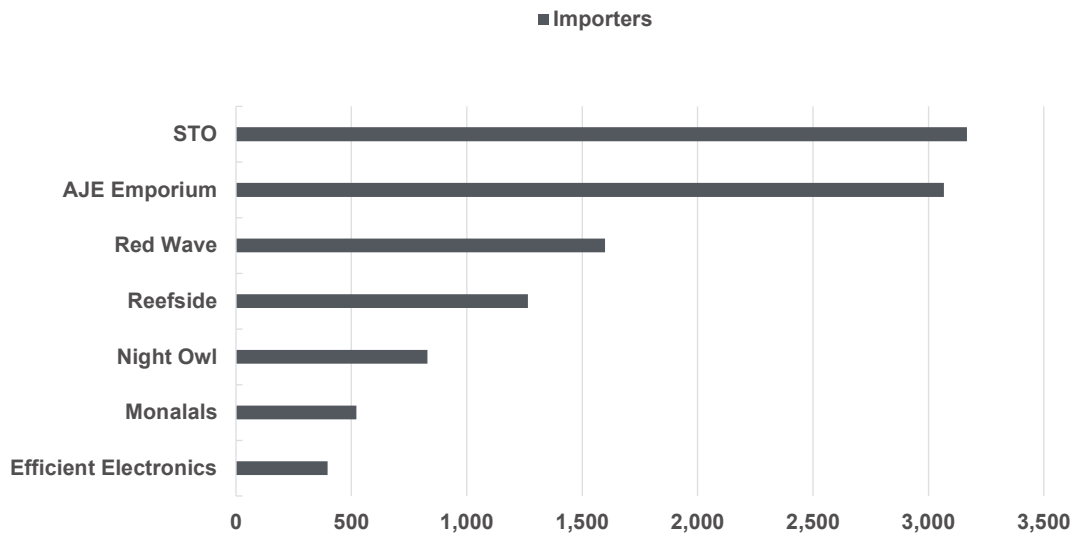


Figure 6.2 Major importers of refrigerators in 2016

6.4. Brands in the Market

The top importers in 2016 sold approximately 15 brands of refrigerators. The brands sold include Hitachi, Panasonic, Sharp, Samsung, LG, Toshiba, Nikai, Whirlpool, Super General, Akira, Skyworth, Nikura, and Westpoint. Table 6.0 below shows the top brands of refrigerators imported by the top importers in 2016.

Brand	Importer
Hitachi	STO, Red Wave
Panasonic	AJE Emporium, Red Wave, Monalals
Samsung	AJE Emporium, Red Wave, Monalals
Toshiba	AJE Emporium
Sharp	AJE Emporium, Red Wave, Monalals, Night Owl,

	Efficient Electronics
LG	Red Wave, Monalals Night Owl, Reefsider
Nikai	Red Wave
Super General	Monalals
Akira	Monalals
Skyworth	Monalals
Westpoint	Monalals
Nikura	Efficient Electronics
Whirlpool	Reefsider

Table 6.0 Top brands and importers of refrigerators

6.5. Imports by Country of Manufacture

Results of the past 10 years data showed that, majority of the refrigerators imported to the Maldives were manufactured in Thailand. Other top manufacturing countries of the refrigerators imported include China and Singapore. See Figure 6.3 below for the top manufacturing countries of refrigerators imported over the 10 year period.

In 2016, most of the refrigerators imported to the Maldives were also manufactured in Thailand (37%) and China (36%). About 8% of refrigerators imported were manufactured in India while 7% was from Singapore.

Hitachi, Panasonic, Sharp, Samsung, and Toshiba brand refrigerators were manufactured in Thailand. LG brand refrigerators were manufactured in South Korea while Whirlpool brand was manufactured in India. Akira brand was manufactured in Singapore and Nikai was manufactured in UAE.

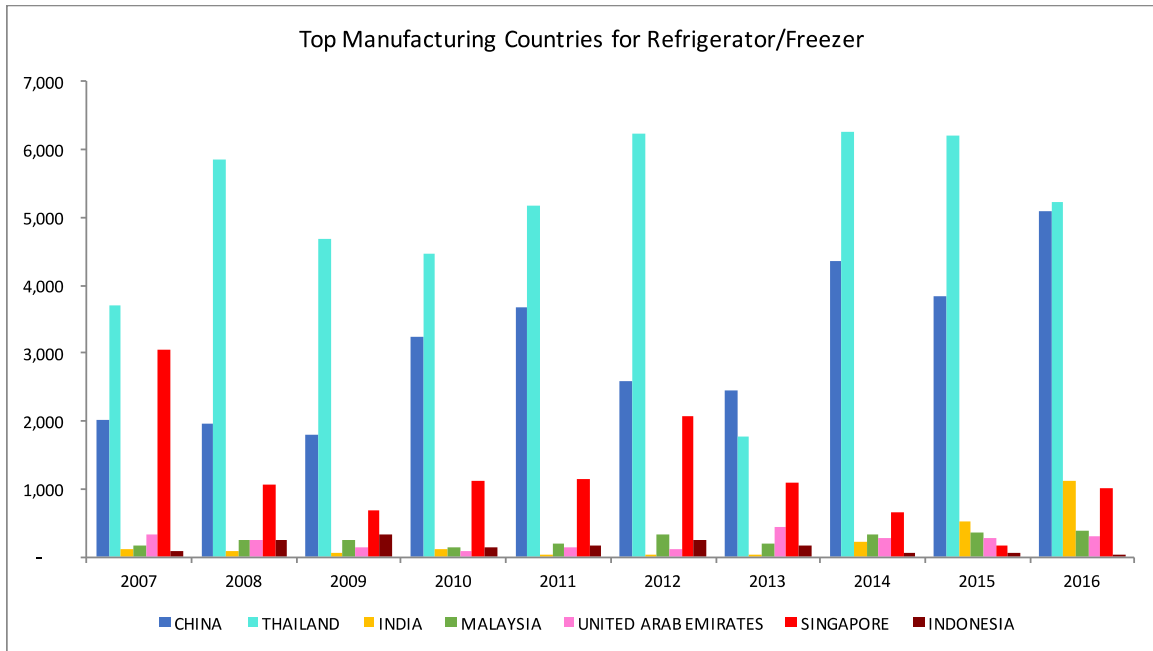


Figure 6.3 Main countries of manufacture origin

6.6. Imports by Country of Shipping

Results from the past 10 years data showed that the top country of shipping origin for refrigerators have been Singapore followed by United Arab Emirates (UAE). Figure 6.4 below shows the top shipping origins of the refrigerators imported from 2006-2016.

In 2016, Singapore accounted for 43%, followed by China (17%), UAE (17%), Thailand (10%) and India (8%). Every two out of five refrigerators imported to Maldives in 2016 was shipped from Singapore.

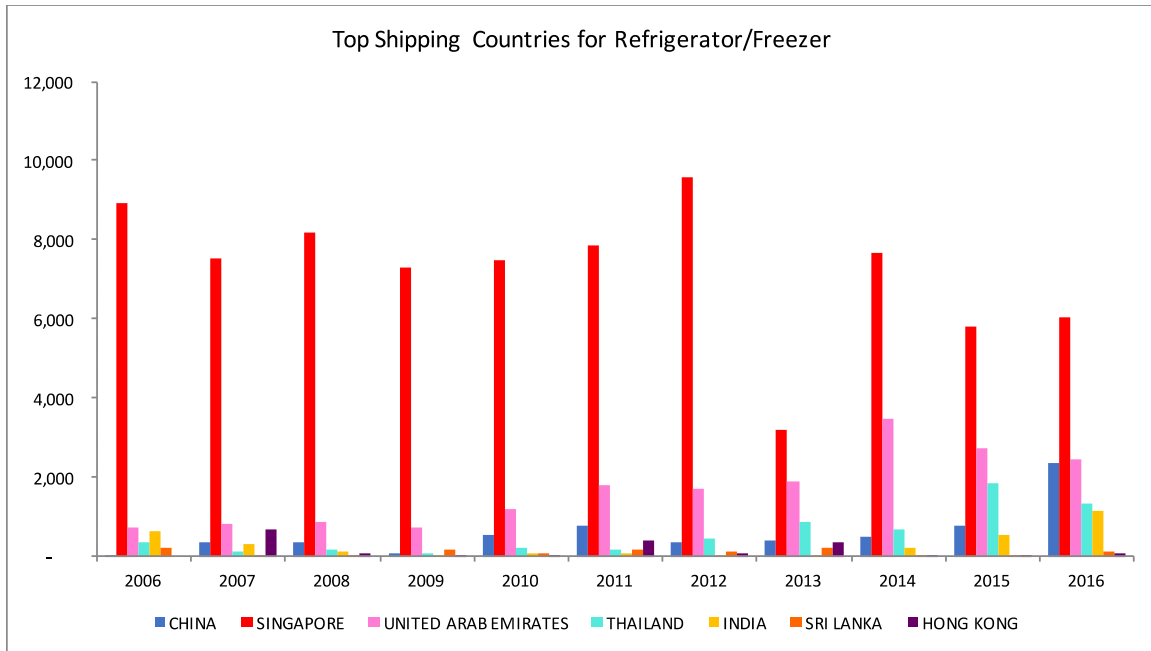


Figure 6.4 Refrigerator imports by country of shipping

6.7. Types of Refrigerators

6.7.1. Refrigerator-freezer – different door configurations

Refrigerator-freezer is the most sold type with top mounted freezer the major door configuration followed by bottom mounted, while side by side are relatively few. .

6.7.2. Inverter type

From the retailer survey, it was found that out of 80 models, 31 were inverters. Information was not available for some models, hence cannot declare that rest of the models are non-inverters.

6.7.1. Refrigerant Used

Amongst the models analysed, 17 models had a “Non-CFC” refrigerant. Other refrigerant types include R600a and HFC-134a.

6.7.2. Different sizes of refrigerators

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.

6.8. Energy Consumption

Among the models explored, refrigerators with the freezer on top and with capacity 240L, 260L and 330L had the lowest annual energy consumption value with 131.40kWh. They are Whirlpool brand top freezers with model number FP263D, FP283D and FP343D respectively. These are inverter refrigerators imported and manufactured in India. Three models of this kind were found in the market from the retailer survey. Refrigerator of capacity 601L had the highest annual energy consumption value with 635kWh. This was an LG brand French door refrigerator (GF-D6011LB).

Improvements by manufacturers for higher energy efficiency of refrigerators include better compressors, improved insulation, more efficient fans and microchip control of the defrost cycle. For small refrigerator-freezers (capacity below 60L) the MEPS levels in kWh/annum are: EU 258; US 294; China 394; Australia/New Zealand 448; and India 522.

6.9. Quantity Forecasted

Annual refrigerator imports forecasted to be around 15,000 by 2025. A refrigerator/freezer is a significant energy consumer in households. Nearly all households contain at least one refrigerator that is operating 24 hours a day, 365 days a year. Household refrigerators and freezers are also used in commercial settings such as offices and shops. Hence, a substantial stock of refrigerators exists in the Maldives. The average refrigerator life is estimated to be 15-17 years. Our forecast is that imports of refrigerators will remain around 15,000 per year and will peak when the planned residential developments in Hulhumale' are realized.

Consumers appear to have inadequate information concerning the relative energy efficiency and energy consumption of refrigerators when making purchasing decisions. Since refrigerator-freezers are used 24 hours for 365 days a year by almost all households, offices and shops, the financial savings and greenhouse gas reductions from energy labeling is going to be substantial. Hence, it is recommended that refrigerator-freezers above 60 L be regulated with energy labeling and minimum energy performance standards.

7. WASHING MACHINE

7.1. Monetary Value of Imports

MVR 35.5 million worth washing machines were imported in 2016. CIF value of washing machines peaked in 2015. CIF value of washing machines imported reached MVR 43.25 million in 2015 and there was drop in 2016. The overall trend is a positive growth except for the global financial crisis year 2009.

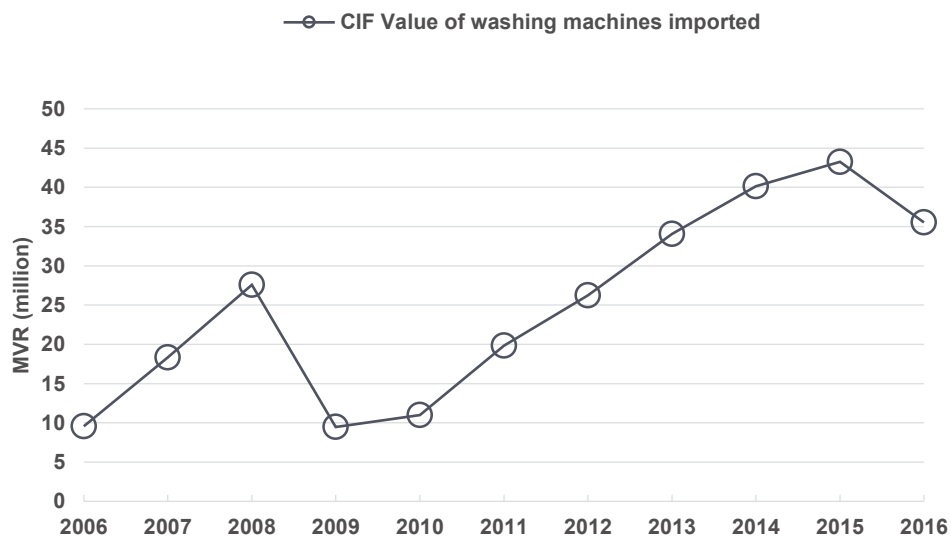


Figure 7.0 CIF value of washing machines imported in MVR (million) from 2006-2016

7.2. Number of Units Imported

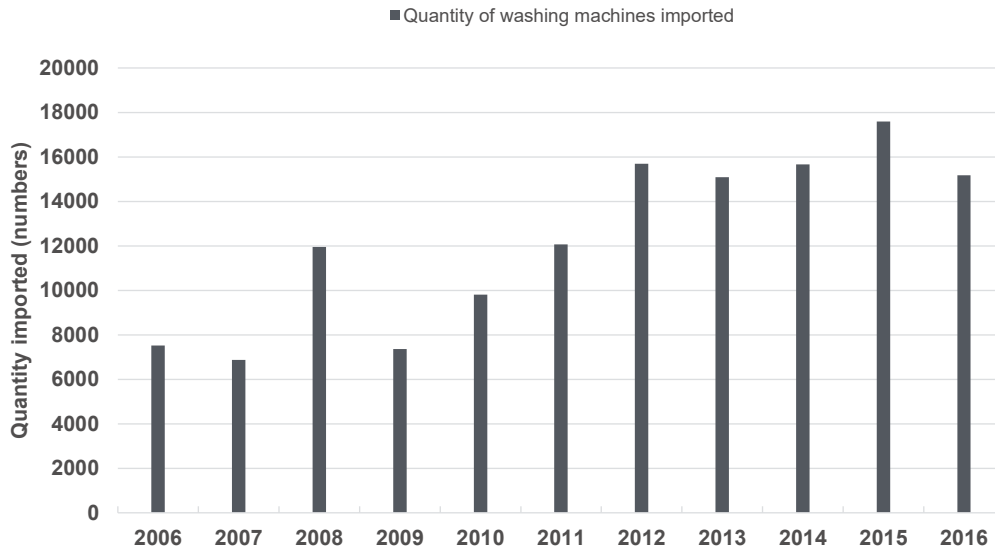


Figure 7.1 Quantity of washing machines imported in 2015

Number of washing machines imported peaked in 2015. The number of units of washing machines imported annually to the Maldives reached a high of 17,594 in 2015. The number of washing machines imported annually has doubled over the last ten years. Quantity of washing machines imported over the past ten years increased from 7,516 in 2006 to 15,168 in 2016.

7.3. Major Importers

The top importers of washing machines varied in the last 10 years. Top importers include, Brotherhood, Monalals and STO. Brotherhood was the top importer in 4 years, STO and Monalals in 2 years. It is hard to pinpoint the lead importer of washing machines, however it can be noted that the top importers are Brotherhood, Monalals, STO and AJE Emporium

In 2016, seven companies imported 82% of washing machines. Efficient Electronics and Red Wave were the leading importers of washing machines in 2016 and accounted for 23% and 16% of imports respectively. STO (14%) and Reefsides (10%) were the third and fourth largest importers of washing machines respectively. Figure 7.2

shows the top importers of washing machines in 2016. Top importers of washing machines for the last 10 years are presented in Annex E.

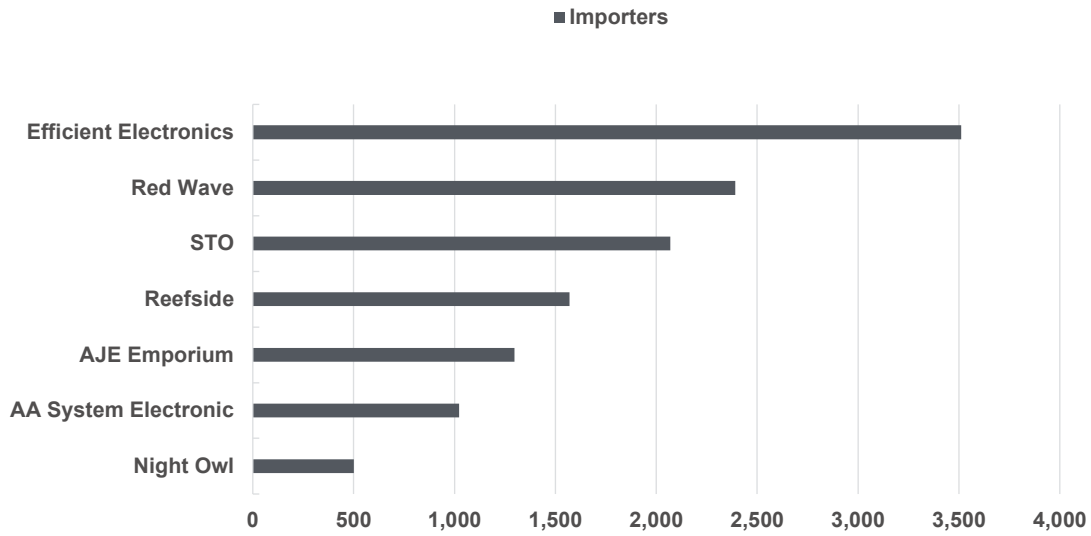


Figure 7.2 Major importers of washing machines in 2016

7.4. Brands in the Market

Approximately 15 brands of washing machines were sold by the top importers in 2016. The brands in market include: Toshiba, LG, Whirlpool, Super General, Hitachi, LANZA, Nikai, Panasonic, Samsung, Sharp, Geepas, Aifa, Singsung, Beko and Sokama. Table 7.0 below shows the top brands of washing machines sold by the top importers of 2016.

Brand	Importer
Super General	Efficient Electronics, AJE Emporium
Panasonic	Efficient Electronics, AJE Emporium, Night Owl
Toshiba	Efficient Electronics, AJE Emporium, Night Owl, Red Wave
LG	AJE Emporium, Night Owl, Red Wave, Reefside
Geepas	Red Wave
Nikai	Red Wave
Samsung	Red Wave
Sharp	AJE Emporium, Night Owl, Red Wave
Lanza	Red Wave
Singsung	Night Owl
Hitachi	STO
Whirlpool	Reefside
Beko	Night Owl

Table 7.0 Top brands and importers of washing machines

7.5. Imports by Country of Manufacture

Majority of the washing machines imported to Maldives are manufactured in China. Analysis of past 10 years data showed that China is the lead country of origin for washing machines every year. Followed by China, the second highest quantity of washing machines imported are manufactured in Thailand.

Similarly, in 2016 the bulk of washing machines imported to the Maldives in 2016 were manufactured in China (58%) and Thailand (17%). See Figure 7.3 below for top manufacturing countries of the washing machines imported from 2007-2016.

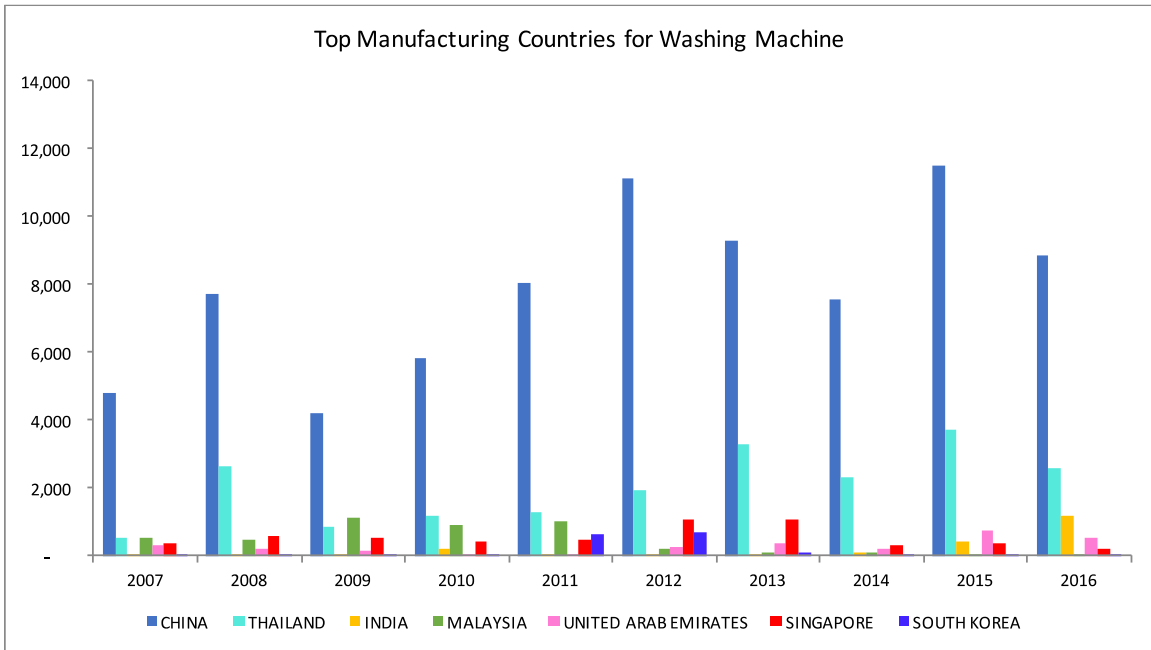


Figure 7.3 Main countries of manufacture origin

7.6. Imports by Country of Shipping

Data analysed for the past 10 years showed that China and Singapore is the main countries of shipping origin for washing machines.

Similarly, in 2016 China is the top country of shipping for washing machines imported to the Maldives with 44%, followed by Singapore (23%), UAE (19%), and Thailand (4%). Every two out of five washing machines imported to Maldives in 2016 were shipped from China. Figure 7.4 below shows the main countries of shipping origin for washing machines imported from 2006 to 2016.

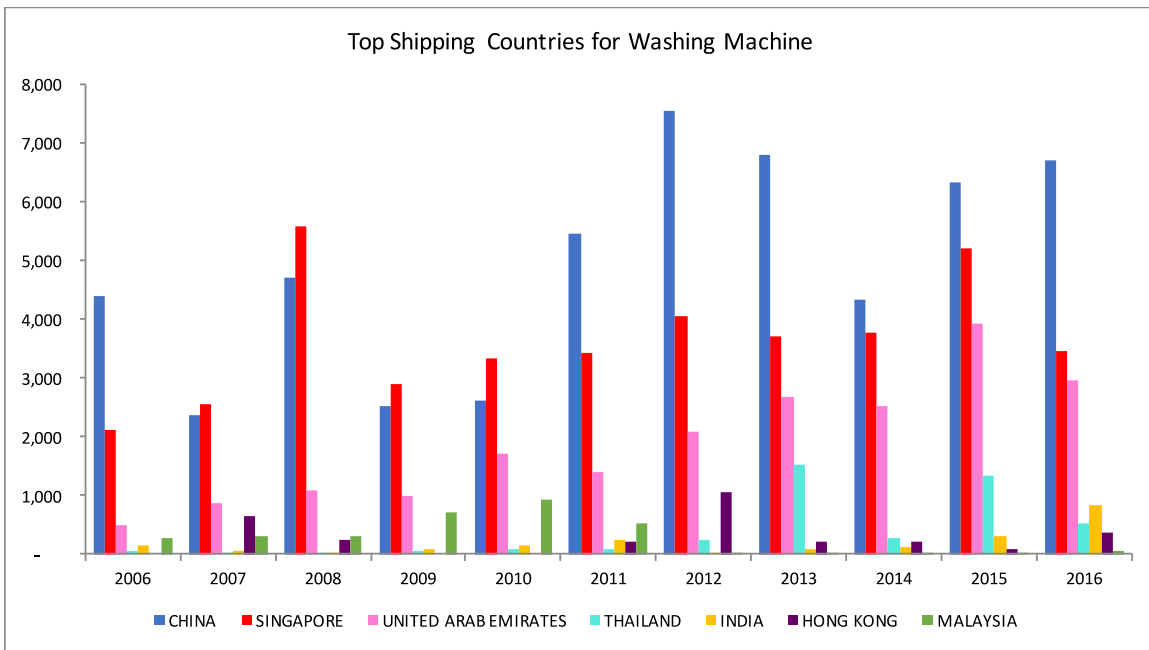


Figure 7.4 Proportion of washing machine imports by country of shipping

7.7. Types of Washing Machines

7.7.1. Top load and front load

Household washing machines are classified into vertical axis (agitator and impeller) and horizontal axis (drum). These two types are referred to as top load and front load. Top load is dominant in market.

7.7.2. Digital inverter motors

Brushless digital inverter motors are believed to run cooler and uses less energy. It is available in next generation front load models of washing machines. They are not yet available in Maldives.

7.7.3. Different sized of washing machines

Most products are in the range of 5kg to 14kg capacity. The semi-automatic top load models are bigger in size and consume more water.

7.8. Energy Consumption

Average energy consumption for washing machines is 160kWh/year.

The annual energy consumption of washing machines will vary significantly for households. For the purposes of this estimate, it is assumed that washing machines are used 2 hours per day, 4 times per week and 48 weeks per year. Among the models explored in the market, an inverter front load auto washing machine had the least annual energy consumption with 122kWh. It is a 7Kg washing machine of LG brand (FH0C3QDP2) which also had A+++ (European Star) energy label attached to it. Details of shipping origin and origin of manufacture were not available for this model.

A non-inverter auto top load washing machine had the highest annual energy consumption with 184.32kWh. This is a 10Kg washing machine of Toshiba brand imported and manufactured in Thailand. It also had an energy label from Thailand with a rating of 5, which is also the highest energy efficiency rating.

Energy consumption of washing machines will depend on wash performance and spin performance which have considerable impacts on energy use. In addition, energy consumption can be rated per unit of load capacity or drum volume and whether the machine uses hot water or not.

7.9. Quantity Forecasted

Washing machine imports forecasted to be around 25,000 by 2025. A washing machine is a significant energy and water consumer in households. Nearly all households contain at least one washing machine that is operating a minimum of once a week. A substantial stock of washing machines exists in the Maldives. The forecast is that imports of washing machines will be over 17,000 units a year and reach around 25,000 per year by 2025. The planned residential developments in Hulhumale' will lead to a significant increase in washing machines imported.

Front load washing machines are usually more water and energy efficient. They are gentler on clothes, use less detergent, produce drier clothes, and save space as they can be installed under a bench top. However, the preference in the Maldives is for top load semi-automatic washing machines. This may be due to perceptions on proper cleaning and being used to the semi-automatic models.

In the Maldives washing machines are of large size, used frequently and often washed on partial loads or single items. Hence, there is significant scope for money saving and greenhouse gas reduction through both saving of water and energy. In this context, it is recommended that washing machines be regulated through water efficiency labeling and standards as well as energy efficiency labeling and standards.

8. TELEVISIONS

8.1. Monetary Value of Imports

MVR 130.8 million worth televisions were imported in 2016. A steady increasing trend in CIF value is observed for televisions. CIF value of televisions imported has doubled over ten years from MVR 60 million in 2006 to MVR 130.8 million in 2016.

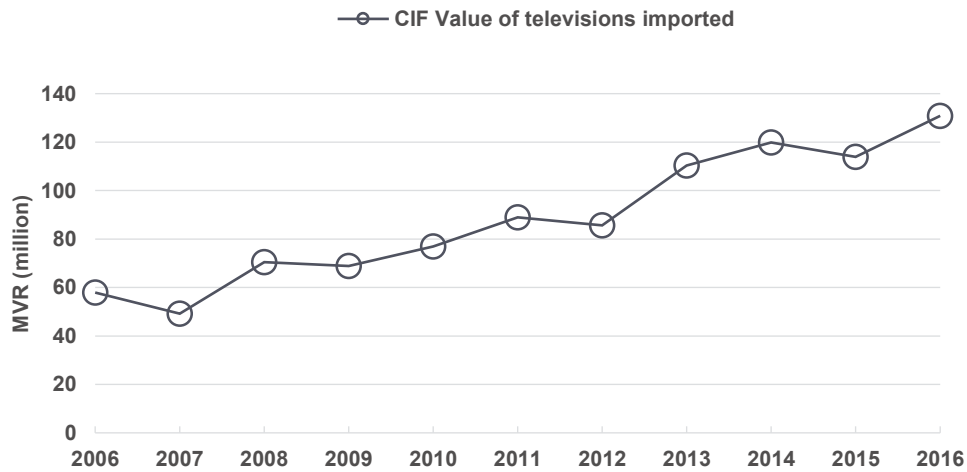


Figure 8.0 Figure 5.0 CIF value of televisions imported in MVR (million) from 2006-2016

8.2. Number of Units Imported

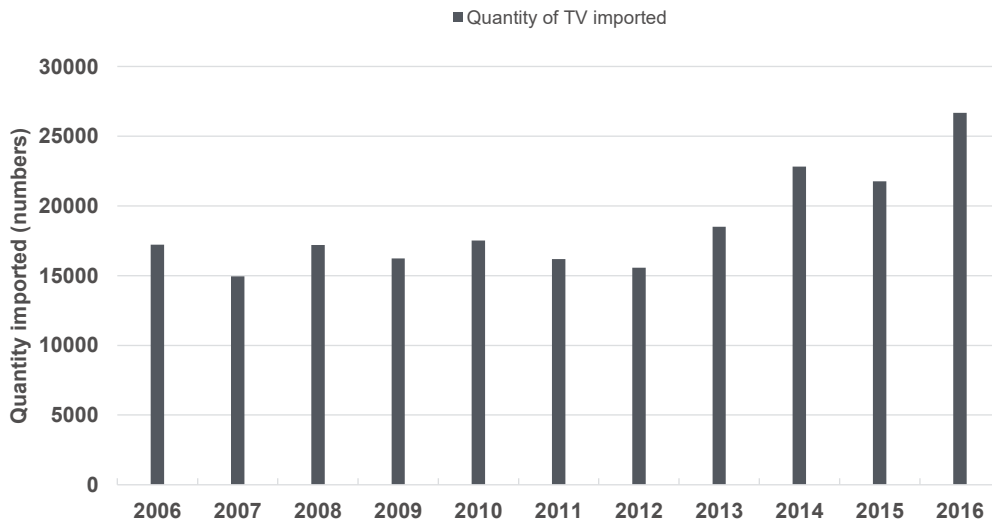


Figure 8.1 Quantity of televisions imported from 2006-2016

Number of televisions imported has remained steady. The number of units of televisions imported to the Maldives annually remained steady between 15,000 and 20,000 from 2006 to 2013. Peak import of television sets occur in football world cup years. In 2014 there was a jump to over 22,000 units and in 2016 reached a record high of 26,664. Quantity of televisions imported over the past ten years increased from 17,228 in 2006 to 26,664 in 2016.

8.3. Major Importers

Reefside has been the top importer of Television over the past 10 years, taking the lead in 7 years. Following reefside, the next top importer of Television is STO. Other top importers include Night Owl, Monalals, AJE Emporium and Bharat Enterprises.

In 2016, Eight companies imported 79% of televisions. Reefside is the leading importer of televisions (21%) closely followed by STO (20%). Other main importers in 2016 are Night Owl (13%), ELL (8%) Asters (7%), Tech Mart (4%) and AJE Emporium (4%). Figure 8.2 below shows the top importers of Television in 2016. The top importers of Televisions from 2006 to 2016 will be presented in Annex F.

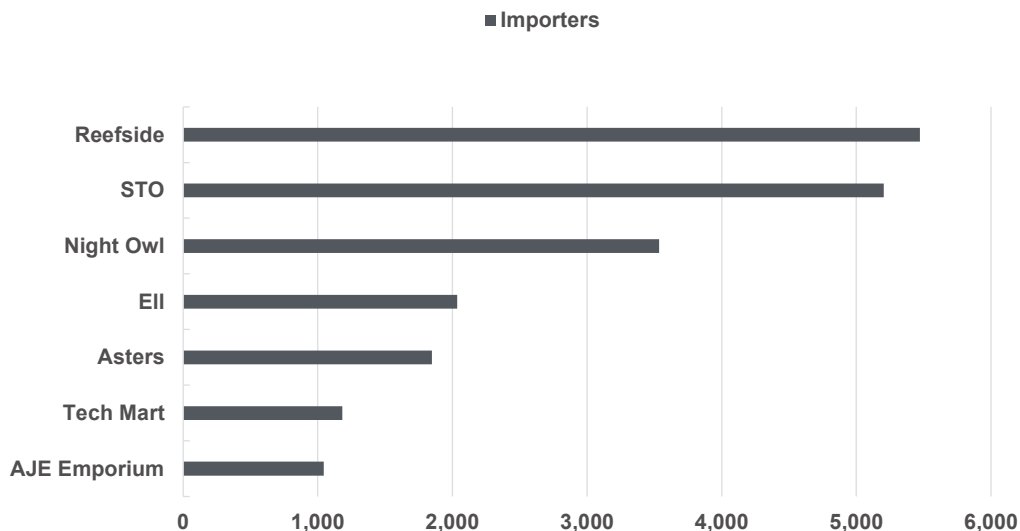


Figure 8.2 Major importers of televisions in 2016

8.4. Brands in the Market

For the Televisions imported to Maldives from 2007 to 2016, top countries of manufacture origin are Malaysia and China.

The top importers of 2016 sold approximately 12 brands of Televisions. The brands in the market include: Samsung, Sony, LG, Hisense, Panasonic, Philips, Sharp, Nikai, Skywoths, TLC, and Hitachi. Table 8.0 below shows the top brands of TV imported by the top importers in 2016.

Brand	Importer
LG	Reefside, AJE Emporium
Hinsense	Reefside, Night Owl
Sony	Reefside, AJE Emporium, Night Owl
Philips	STO, Tech Mart
Hitachi	STO
Samsung	STO, AJE Emporium, Night Owl, Tech Mart
Sharp	AJE Emporium, Night Owl
Toshiba	Night Owl
Panasonic	AJE Emporium
Skyworth	Asters
Philips	Tech Mart

Table 8.0 Top brands and importers of televisions

8.5. Imports by Country of Manufacture

Analysis of the 10 years data showed that, among the Televisions imported to Maldives, majority were manufactured in China and Malaysia.

Accordingly, 60% of televisions imported to Maldives in 2016 was manufactured in China and about 13% of televisions imported were manufactured in Malaysia while 5% was from Vietnam and India each followed by Thailand (4%). Figure 8.3 below shows the top countries manufacture for the Televisions imported from 2007 to 2016.

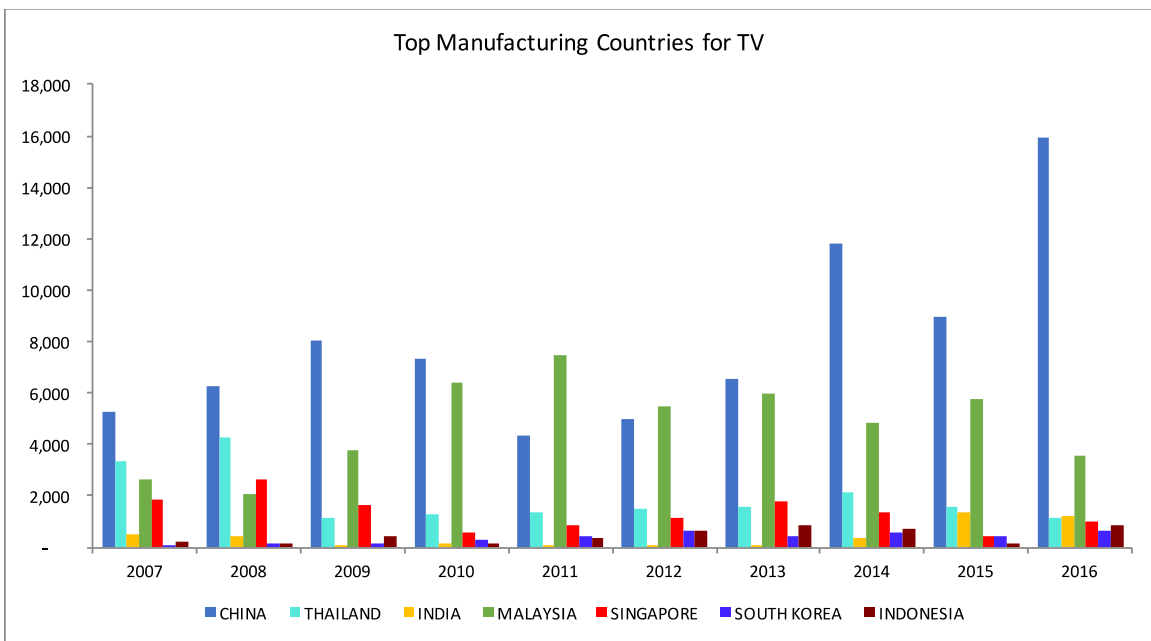


Figure 8.3 Main countries of manufacture origin

8.6. Imports by Country of Shipping

Among the Televisions imported from 2007 to 2016, majority was shipped from Singapore. See Figure 8.4 below.

In 2016, Singapore is the top country of shipping for televisions imported to the Maldives with 49%, followed by China (18%), UAE (12%), Thailand (4%) and India (4%). One out of every two televisions imported to Maldives in 2016 was shipped from Singapore.

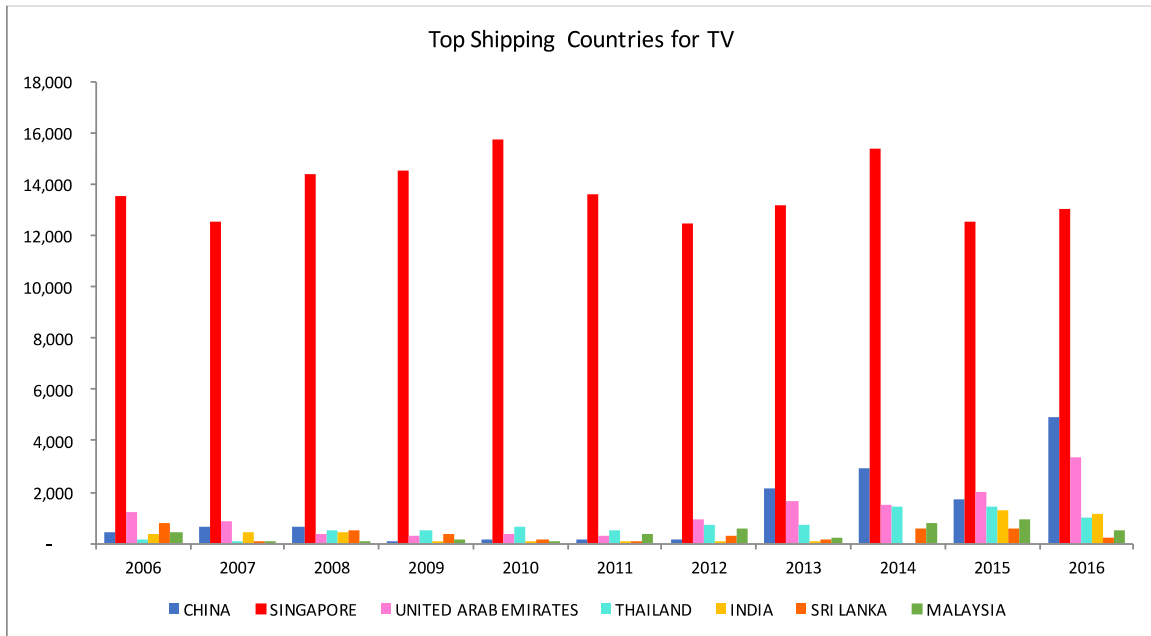


Figure 8.4 Proportion of television imports by country of shipping

8.7. Types of Television

8.7.1. Television technologies

Common display technologies include liquid crystal display (LCD), light emitting diode (LED), cathode-ray tube (CRT), and plasma display panel (PDP).

8.7.2. Minimum Energy Performance Standard

Australia and EU have set MEPS for televisions. Australian MEPS for TVs is currently 20-30% more demanding than the EU's MEPS. The Australian MEPS for 42" TV is 142W and in EU is 184W.

8.7.3. Different sizes of televisions

Most televisions sold in the Maldives have screens in the range of 32 inches to 65 inches.

8.8. Energy Consumption

Average energy consumption for TVs is 104.4 kWh/year. The following assumptions

were made when calculating the annual energy consumption values for the models explored in the study (1) TVs will be used 4 hours a day on average per day and 90% throughout the year (2) Standby power rating of 0.5W used for those TVs listed where the power rating was not available.

TV with the screen size 24 inch had the lowest annual energy consumption value with 55kWh. This was a Philips brand (24PHA4100/98) LED HD TV manufactured in China and imported from Singapore. It also had an energy label sticker on it with a rating of 3 ticks. A similar annual energy consumption value was also noted in another TV model with the screen size of 40 inches. This was a Panasonic brand (40D400) LED LCD TV imported and manufactured from Malaysia. The annual energy consumption value calculated for this report may differ from the value stated by the manufacturer as it will be calculated under different assumptions.

The highest annual energy consumption value was noted in a TV with screen size 40 inches, with 225.39kWh. This was a Sony brand (40EX400) LCD TV manufactured in Malaysia and imported from Singapore.

8.9. Quantity Forecasted

TV imports forecasted to be over 30,000 by 2025. Ownership, use hours, and screen size of televisions are increasing. Every football world cup year leads to jumps in television imports. With the new proposed 25,000 apartment housing development in Hulhumale' the demand for large screen televisions will surge.

Televisions consume more energy than people perceive. A large screen (43 inches to 51 inches) 3 star rated TV on for 10 hours a day uses around 471kWh a year (generating around half a tonne of greenhouse gases) — more than an average sized (400L to 500L) 4 star family refrigerator-freezer, which uses about 336kWh/year.

The number of televisions, screen sizes and use hours are likely to increase and households make active choice decisions on the type, size, model and brand of televisions. In this context, it is recommended that televisions be regulated through

energy efficiency labeling and standards.

9. LIGHTS

9.1. Monetary Value of Imports

MVR 23.5 million worth lights were imported in 2016. A steady upward trend in CIF value of lights imported. CIF value of lights imported annually more than doubled in 4 years from 2010 to 2014. Having reached a peak in 2014 CIF value of lights imported dropped in 2015.

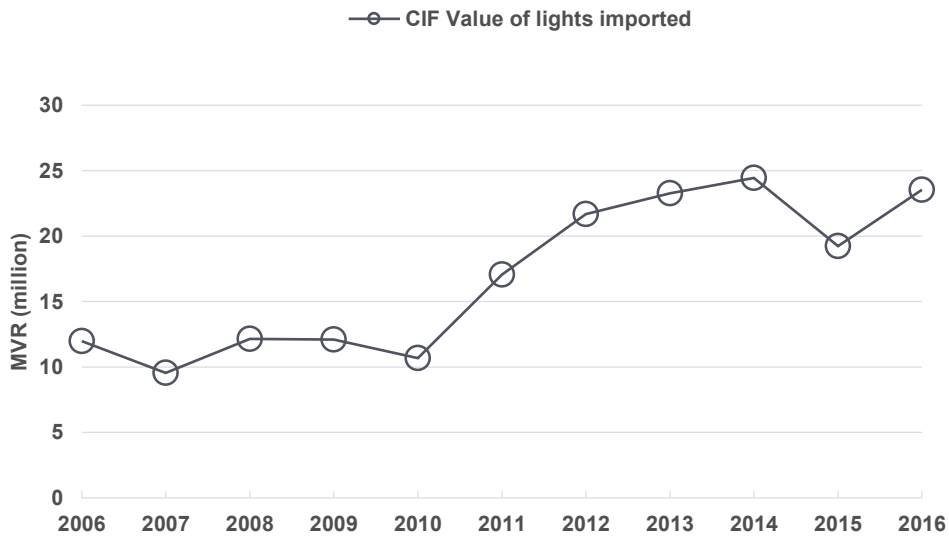


Figure 9.0 CIF value of lights imported in MVR (million) from 2006-2016

9.2. Number of Units Imported

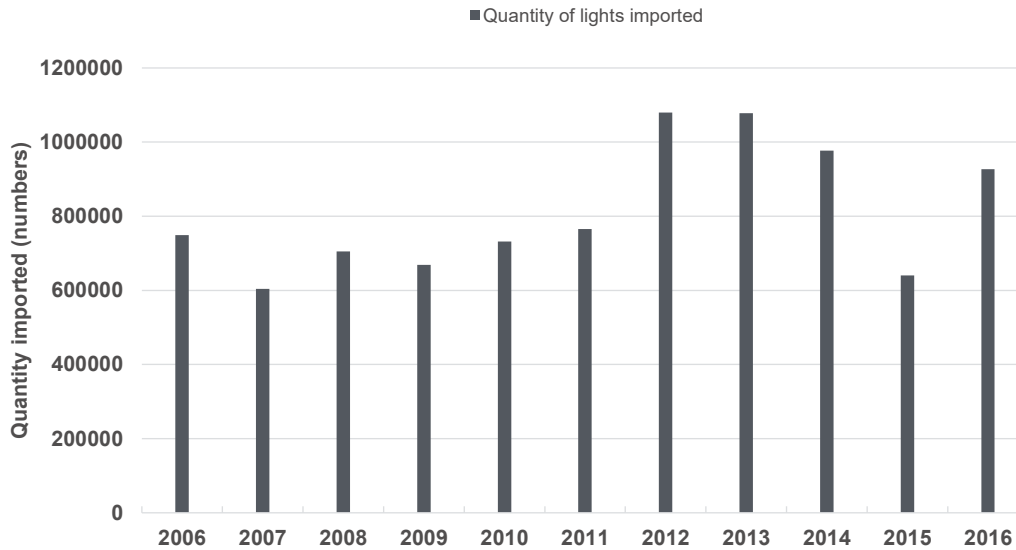


Figure 9.1 Quantity of lights imported from 2006-2016

Number of lights imported peaked in 2012. The number of units of lights imported to the Maldives annually peaked in 2012 with 1.1 million units. Since then there is a declining trend and reached a low of 640,640 in 2015. Quantity of lights imported over the past ten years increased from 749,124 in 2006 to 927,261 in 2016.

9.3. Major Importers

The top importers of lights varied in the last 10 years. Top importers include, Sonee Hardware and Sun Front. It is hard to pinpoint the lead importer of lights. The top importers for each year from 2006 to 2016 are presented in Annex G.

In 2016, ten companies imported 48% of lights. Horizon Fisheries Pvt Ltd is the leading importer of lights and they imported 19% of lights in 2016. Share Maldives is the second largest importer (6%) followed by STO (5%), Sonee Hardware (4%) and Veligaa Hardware (3%). See Figure 9.2 below for the top importers of lights in 2016.

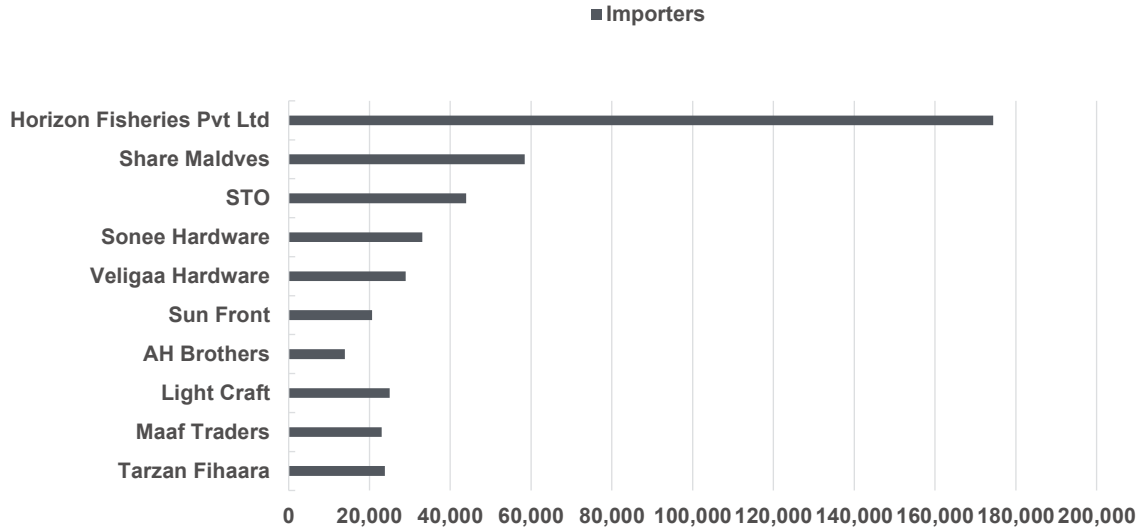


Figure 9.2 Major importers of lights in 2016

9.4. Brands in the Market

About eight brands of household lights were sold by the top importers in 2016. The brands sold include: LG, Philips, Osram, Veto, Sokama, GE Lighting, PowerPac, and ETiSSL. Table 9.0 below shows brands of lights sold by the top importers in 2016.

Brand	Importer
Socama	Sonee Hardware, Veligaa Hardware
Osram	Sonee Hardware, Veligaa Hardware, AH Brothers
GE Lighting	Sun Front
PowerPac	Night Owl
Philips	Veligaa Hardware, AH Brothers, AJ Emporium
LG	AJE Emporium
Veto	Veligaa Hardware

Table 9.0 Top brands and importers of lights

9.5. Imports by Country of Manufacture

Data analysed for the past 10 years showed that majority of the lights imported to Maldives were manufactured in China. Lights manufactured in Thailand make up the second highest following China. A few lights manufactured in Indonesia were also imported during the period 2007 to 2010. From 2010 onwards, the quantity declined. As seen from the Figure 9.3, a large proportion of lights manufactured in India were imported in 2011. The rest of the years, only a small quantity of lights manufactured in India were imported.

Lights imported to the Maldives in 2016 were manufactured in China (55%) and Thailand (36%). Less than 5% of the lights imported were reported to have been manufactured in UAE (3%) and Singapore (2%).

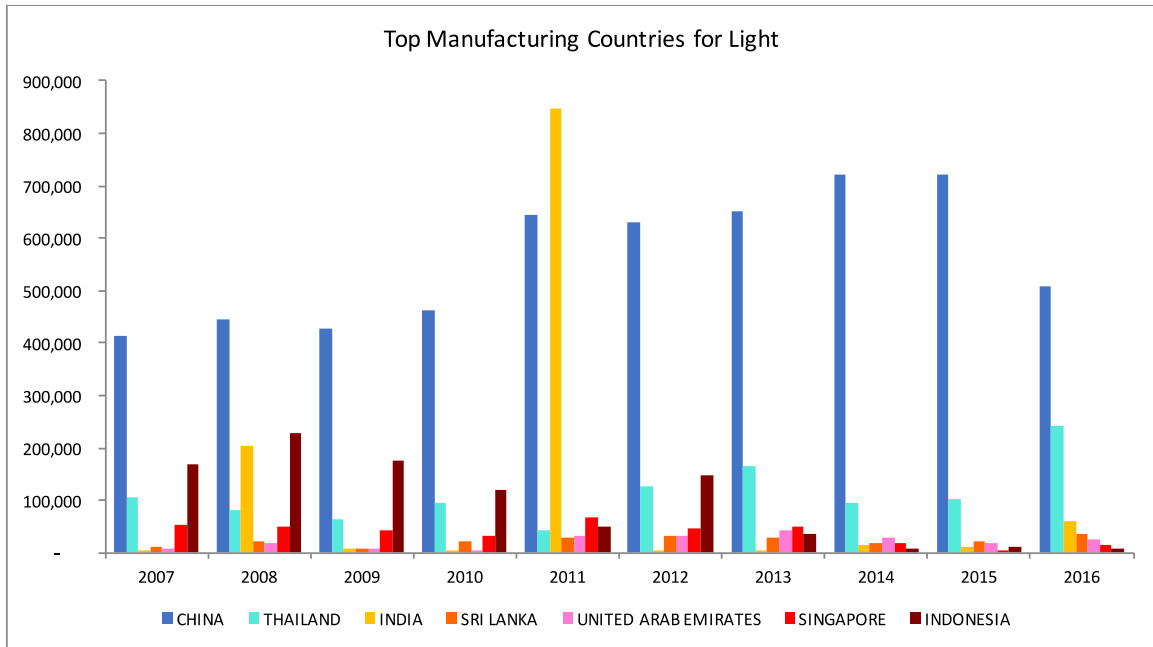


Figure 9.3 Main countries of manufacture origin

9.6. Imports by Country of Shipping

Lights imported to Maldives were shipped from a variety of countries over the period

2006 to 2017. As seen in Figure 9.4 below, a significant quantity of lights were shipped from India in 2011. In the same year, similar quantity of lights manufactured in India were also imported. In the years from 2006 to 2010, main countries of shipping include Singapore and United Arab Emirates (UAE). A few lights were also shipped from Indonesia. From 2012 onwards, a large quantity of lights were shipped from China, whereas the quantity shipped from Singapore reduced. In 2015, majority of the lights were shipped from UAE.

In 2016, China is the top country of shipping for refrigerators imported to the Maldives with 31%, followed by Singapore(24%), UAE (20%), Thailand (8%) and Hong Kong (2). One out of three lights imported to Maldives in 2016 was shipped from China.

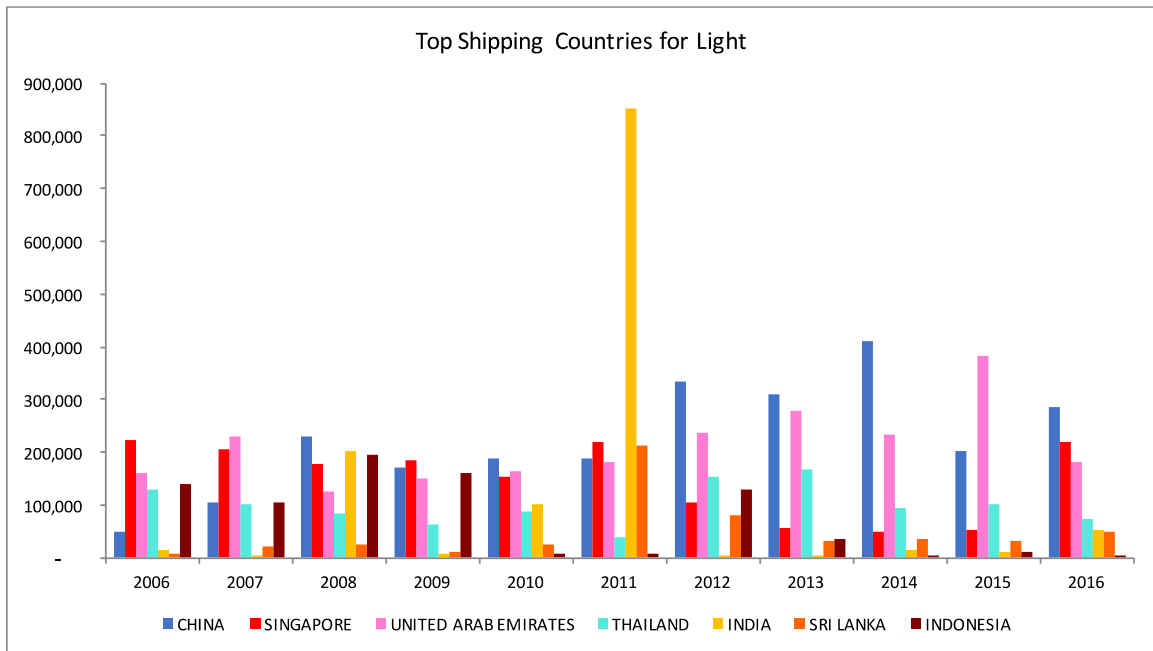


Figure 9.4 Proportion of light imports by country of shipping

9.7. Types of Lights

9.7.1. CFL

Most common household light in market is compact fluorescent lamps (CFLs) that

include the curly, screw-in versions of the long tube fluorescent lights for which the ballast is integrated into the lamp.

9.7.2. LED

Most energy efficient lighting technology available in the market for households is Light Emitting Diode (LED). The purchase price of LED's are continuing to go down and all retailers now carry LED lights.

9.7.3. Incandescent filament

There is a significant reduction in incandescent filament lamps in market that may or may not contain gases influencing process of incandescence.

9.8. Energy Consumption

Average energy consumption for lights varies from 20 to 300kWh/year.

The following assumptions were made when calculating the annual energy consumption values for the models explored in the study: lights are used 12 hours per day and 90% throughout the year.

Majority of the lights studied in the retailer survey are LED lights. The annual energy consumption value ranged from as low as 19.71kWh to as high as 315.36kWh. They are both Philips brand LED lights.

Generally, a light is more energy efficient if the lumens per watt is higher. It was noted that lights with similar lumens value also had similar annual power consumption values. A Power Pac light (PP6415) had the highest lumens per watt value of 100. This light had a luminous flux of 1500 LM and an annual power consumption value of 59.13 kWh.

The light with the lowest annual energy consumption value was a LED light with a luminous flux of 230 LM with 46 lumens per watt. It was imported and manufactured in China.

The light with the highest annual energy consumption value was a LED light with a luminous flux of 5,100 LM with 63.8 lumens per watt. It was also imported and manufactured in China.

9.9. Quantity Forecasted

Lights imports forecasted to be over 1.25 million by 2025. Around 1 million lamps are sold in the Maldives every year. Furthermore there is a very high stock of lamps in use by households, offices, workplaces and shops.

Individual lamps do not consume large quantities of electricity. However, the average Maldivian home has several lamps. These lamps are switched on and likely to be in use for 365 days a year for at least 6 hours every day. When aggregated, lighting accounts for a significant proportion of the average household's electricity use in the Maldives, especially for the low-income households. Lighting also accounts for a high proportion of end use electricity for commercial purposes.

This study also revealed that consumers face the risk of purchasing inferior LED products at a high price. This could negatively impact on consumer confidence and uptake of the most energy efficient lighting technology available in the market.

In this context, it is recommended that lights be regulated through energy efficiency labeling and MEPS. With the sheer number of lights sold and the different types of lamps in market, it is suggested that the MEE establish a specialist unit and a technical committee for lighting.

10. OVENS

10.1. Monetary Value of Imports

MVR 11.8 million worth ovens were imported in 2016. An increasing trend in CIF value is observed for ovens. CIF value of ovens remained stable from 2006 to 2010. However the CIF value of ovens imported annually tripled from MVR 3.38 million in 2010 to 10.98 million by 2013.

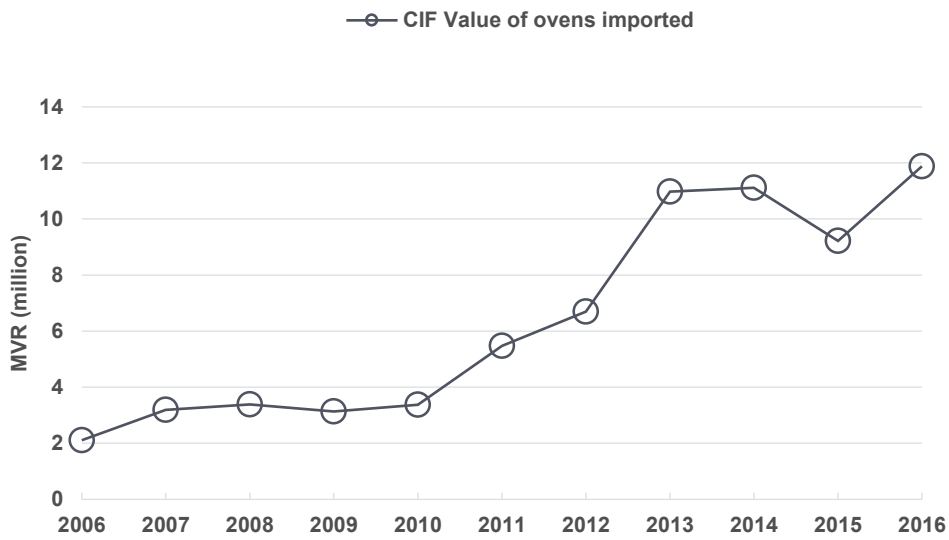


Figure 10.0 CIF value of ovens imported in MVR (million) from 2006-2016

10.2. Number of Units Imported

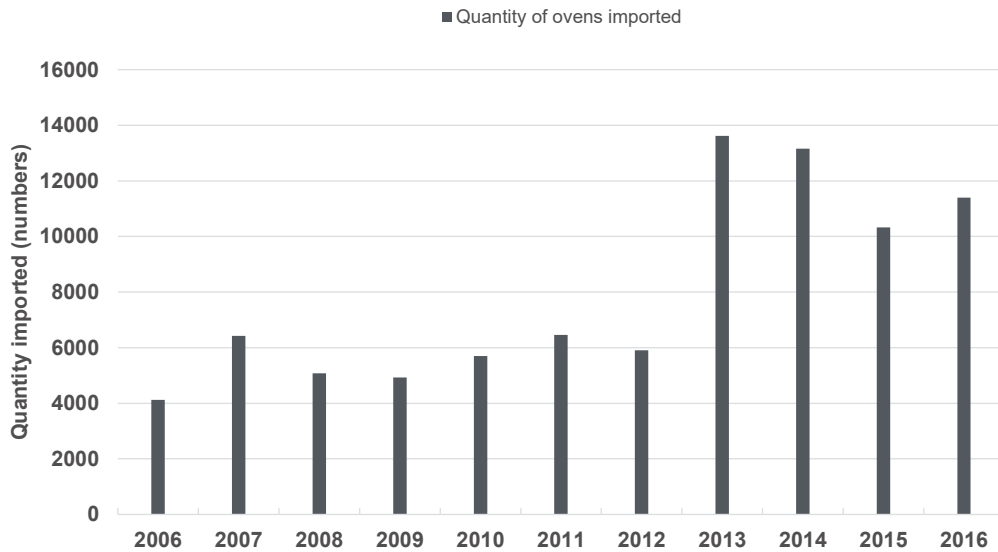


Figure 10.1 Quantity of ovens imported from 2006-2016

A significant increase in ovens imported in 2013 and 2014. The number of ovens imported to the Maldives annually remained around 6,000 until 2013. The quantity of ovens imported more than doubled to over 13,000 in 2013. This increase was evident for two consecutive election years. Quantity of ovens imported over the past ten years increased from 4,120 in 2006 to 11,391 in 2016.

10.3. Major Importers

The top importer of ovens to the market has been Bright Brothers from 2006 to 2011. From 2012 onwards, the top importer has varied between Red Wave and STO. As seen in Figure 10.2 below, Bright Brothers/Agora, Red Wave, STO, AJE Emporium and Monalals have been top importers.

In 2016, eight companies imported 75% of ovens in 2016. Red Wave is the leading importer of ovens and accounted for 42% of imports in 2016. STO is the second largest importer (12%) followed by Night Owl (5%), AJE Emporium (4%) and Reefside (3%). Red Wave is the top importer of ovens. Top importers for each consecutive year are presented in Annex H. See Figure 10.2 below for the top importers of ovens in 2016.

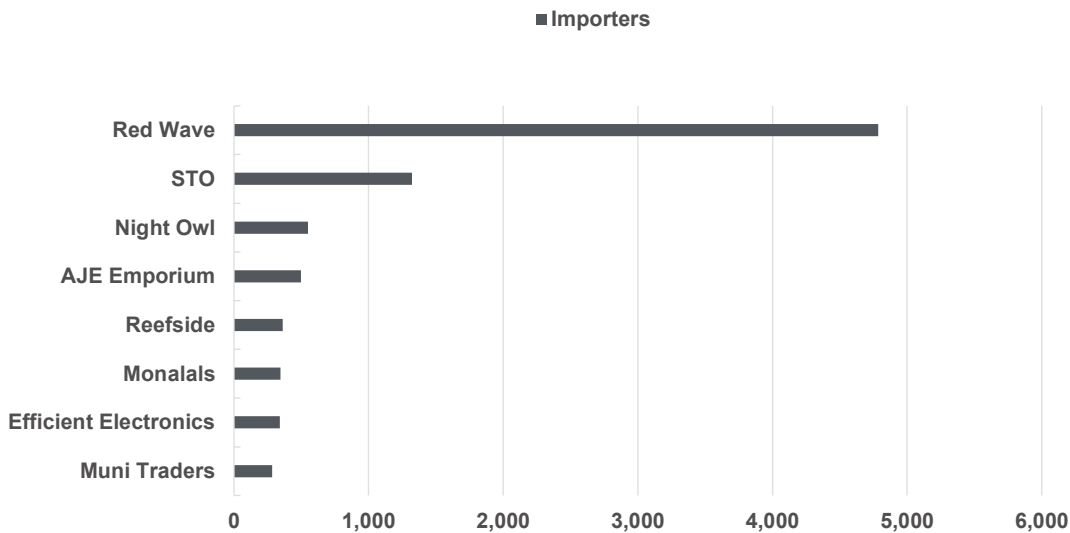


Figure 10.2 Major importers of ovens in 2016

10.4. Brands in the Market

Approximately 25 brands of electric ovens were sold by the top importers of 2016 in Maldives. The brands include: Geepas, Panasonic, Sanford, Cornell, Akai, Sharp, Kenmore, Kenwood, Mebashi, Mistral, Nevika, Nikai, Nikura, Optima, Sachi, Sonashi, Super General, Whirlpool, Optima, Oscar, Indasit, Iona, Nova, and Singsung. Table 10.0 below shows brands of ovens sold by the top importers of 2016.

Brand	Importer
Nikai	Red Wave, Monalals
Samsung	Red Wave
Nikura	Red Wave, Efficient Electronics
Hyundai	Red Wave, Monalals
Cornell	Reefside
Nevika	Reefside
Whirlpool	Reefside
Sanford	STO
Iona	Night Owl
Nova	Night Owl
Singsung	Night Owl
Panasonic	Night Owl, AJE Emporium
Mistral	Monals
Sharp	Monals, AJE Emporium
Optima	AJE Emporium

Super General	AJE Emporium
Kenwood	AJE Emporium
Akai	Monals, AJE Emporium
Sonashi	Efficient Electronics
Sachi	Efficient Electronics
Oscar	Muni Traders
Geepas	Monalals
Indasit	Muni Traders

Table 10.0 Top brands and importers of electric ovens

10.5. Imports by Country of Manufacture

An overwhelming number of ovens imported to Maldives are manufactured in China. Data analysed for the past 10 years showed that, China is the lead country of manufacture for Ovens. In some years, a few quantities of ovens manufactured in UAE and Thailand are also imported. See Figure 10.3 below.

Ovens imported to the Maldives in 2016 were mostly manufactured in China (83%). Relatively few of the ovens imported were manufactured in UAE (2%) and Thailand (1%).

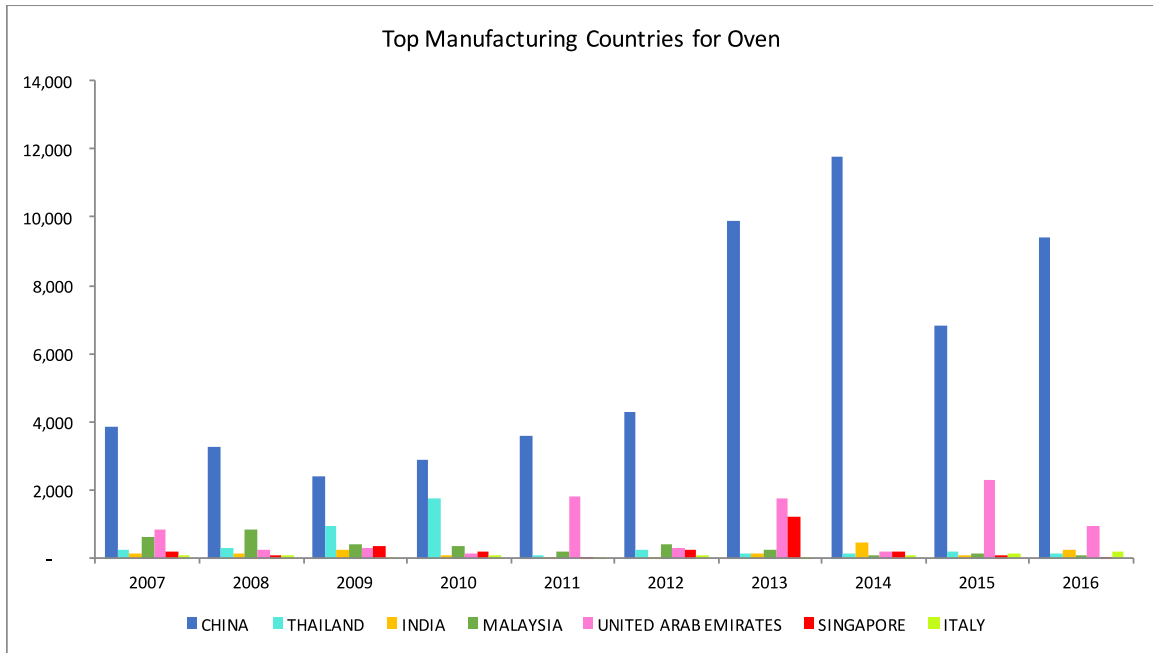


Figure 10.3 Main countries of manufacture origin

10.6. Imports by Country of Shipping

Majority of the ovens imported to Maldives are shipped from UAE. Other top shipping countries include Singapore, China and Thailand. See Figure 10.4 below for the top shipping countries of ovens from 2006 to 2016.

In 2016, UAE is the top country of shipping for ovens imported to the Maldives (72%), followed by Singapore (12%), China (8%), and Thailand (1%). 72% of ovens imported to Maldives in 2016 were shipped from UAE.

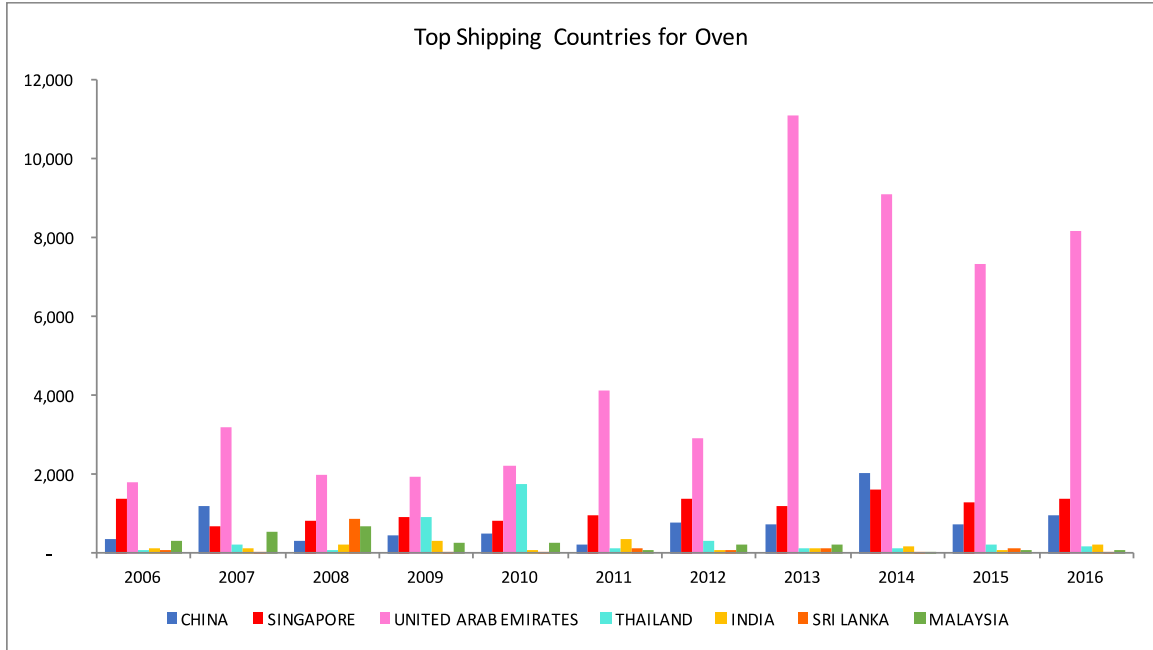


Figure 10.4 Proportion of oven imports by country of shipping

10.7. Types of Electric Ovens

10.7.1. Free standing single ovens

Major types of ovens in the market are free standing single with combination of top, bottom and grill plus fan to optimize different cooking, baking and grilling needs.

10.7.2. Models of ovens

A total of 86 models of ovens were available across 9 retail shops. Of these 86 models in the market, 17 models did not have model numbers.

10.7.3. Different sizes of ovens

The capacity of the ovens in the market range from 16 Litres to 85 Litres.

10.8. Energy Consumption

Average energy consumption for ovens is 160kWh/year. The following assumptions were made when calculating the annual energy consumption values for the models

explored in the study: Ovens are used on average 1.5 hours per week and for 48 weeks.

A wide range of models for ovens were explored in the retailer survey. The annual energy consumption value ranged from as low as 50.4kWh to as high as 201.6kWh. Oven with the lowest annual energy consumption value was a Whirlpool brand oven of capacity 20L. This was a Samsung brand oven with model number ME711K.

Oven of capacity both 75L and 30L had the highest annual energy consumption value of 201.6kWh. However, while the oven with capacity 75L was a Geepas brand (GO4402) oven imported from UAE, the one with capacity 30L was a Nikai brand oven (NT-300) imported from China.

10.9. Quantity Forecasted

Oven imports forecasted to be around 20,000 by 2025. Number of electrical ovens imported increased dramatically in the two consecutive election years of 2013 and 2014. The number of ovens imported doubled from about 6,000 in 2012 to over 13,000 in 2013. Based on simple regression analysis, the number of ovens is forecasted to increase to 20,000 by 2025. The stock of ovens is also likely to be impacted significantly when the planned 25,000 housing units are realized.

Although the Maldives has an existing high stock of household electrical ovens and the stock is likely to increase in the future, the use of electrical ovens is not likely to increase. Ovens are likely to be limited to high use in the month of Ramadan only. The popularity of eating out is on an upward trend and this trend is fast catching up in the small islands as well.

Electrical ovens do use a lot of energy and different brands of oven use more than others. However, ovens are presently a difficult area to regulate for energy efficiency because products are very region specific and product use varies greatly among households.

In this context, it is recommended that ovens be considered for energy efficiency regulation in a later stage.

11. WATER HEATERS

11.1. Monetary Value of Imports

MVR 16.8 million worth water heaters were imported in 2016. A sharp growth in water heater imports since 2010. CIF value of water heaters remained stable until 2010. CIF value of annual imports of water heaters increased by more than three fold from MVR 5.17 million in 2010 to reach MVR 18.2 million in 2014.

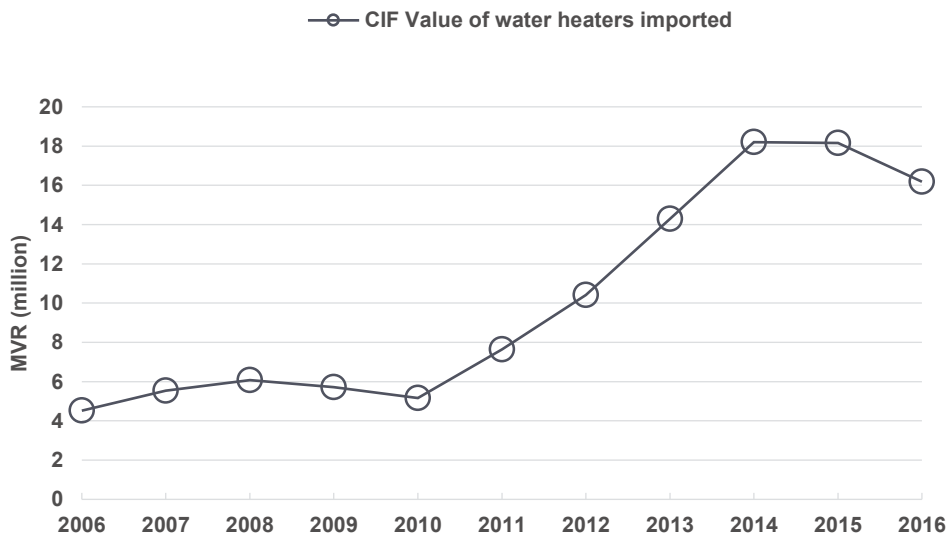


Figure 11.0 CIF value of water heaters imported in MVR (million) from 2006-2016

11.2. Number of Units Imported

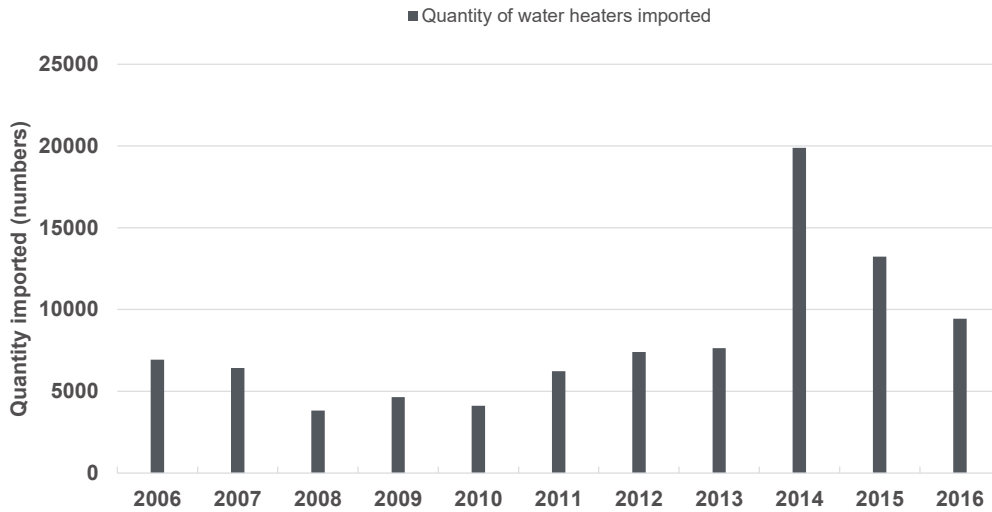


Figure 11.1 Quantity of water heaters imported from 2006-2016

Number of water heaters imported peaked in 2014. The number of units of water heaters imported to the Maldives annually remained below 7500 units until 2014 when it had a big jump from 7042 to 19892 in 2014 . Since then there has been a steady decline reaching 9,445 in 2016. Quantity of water heaters imported over the past ten years increased from 6,930 in 2006 to 9,445 in 2016.

11.3. Major Importers

Top importers of water heaters over the past 10 years varied. Main importers include, Luxury Shopping CNT, Rainbow, Tep-Construction, Pan Ocean, Sonee Hardware and AJE Emporium. Top importers of water heater for the years 2006 to 2016 is attached in Annex I.

Eight companies imported 55% of water heaters in 2016. Sonee Hardware is the leading importer of water heaters (11%) in 2016. STO (10%) and AJE Emporium (9%) are the second and third largest importers of water heaters respectively. See Figure 11.2 below for the top importers of water heaters in 2016.

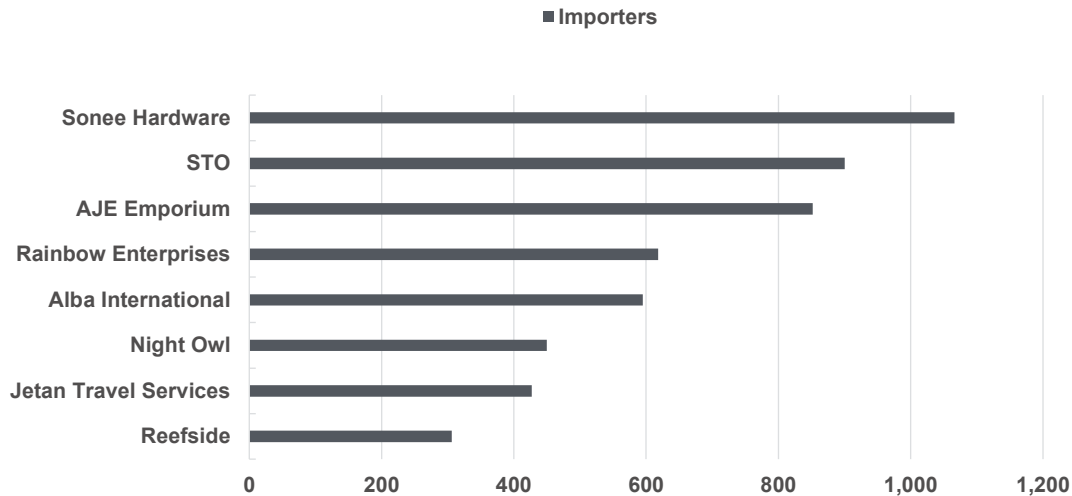


Figure 11.2 Major importers of water heaters in 2016

Eight companies imported 55% of water heaters in 2016. Sonee Hardware is the leading importer of water heaters (11%) in 2016. STO (10%) and AJE Emporium (9%) are the second and third largest importers of water heaters respectively. Sonee Hardware is the top importer of water heaters.

11.4. Brands in the Market

About seven brands of water heaters were sold in by the top importers in 2016. The brands include Ariston, Hitachi, Panasonic, Whirlpool, Sharp, Rheem and Lecston. Table 11.0 below shows the brands of water heaters sold by each of the top importers of 2016.

Brand	Importer
Ariston	Sonee Hardware
Hitachi	STO
Panasonic	AJE Emporium, Red Wave, Night Owl

Rheem	Alba International
Sonashi	Reefside
Sachi	Reefside
Nikura	Reefside
Sharp	Red Wave
Lecston	Red Wave
Whirlpool	Monalals

Table 11.0 Top brands and importers of water heaters

11.5. Imports by Country of Manufacture

Data analysed for the past 10 years showed that majority of the water heaters imported to Maldives are manufactured in China and some in Malaysia. As seen in Figure 11.3 below, a large quantity of water heaters manufactured in Singapore was imported in 2014.

Most of the water heaters imported to the Maldives in 2016 were manufactured in China (37%), and Malaysia (23%). About 16% of water heaters imported were manufactured in Thailand while 10% was from Singapore.

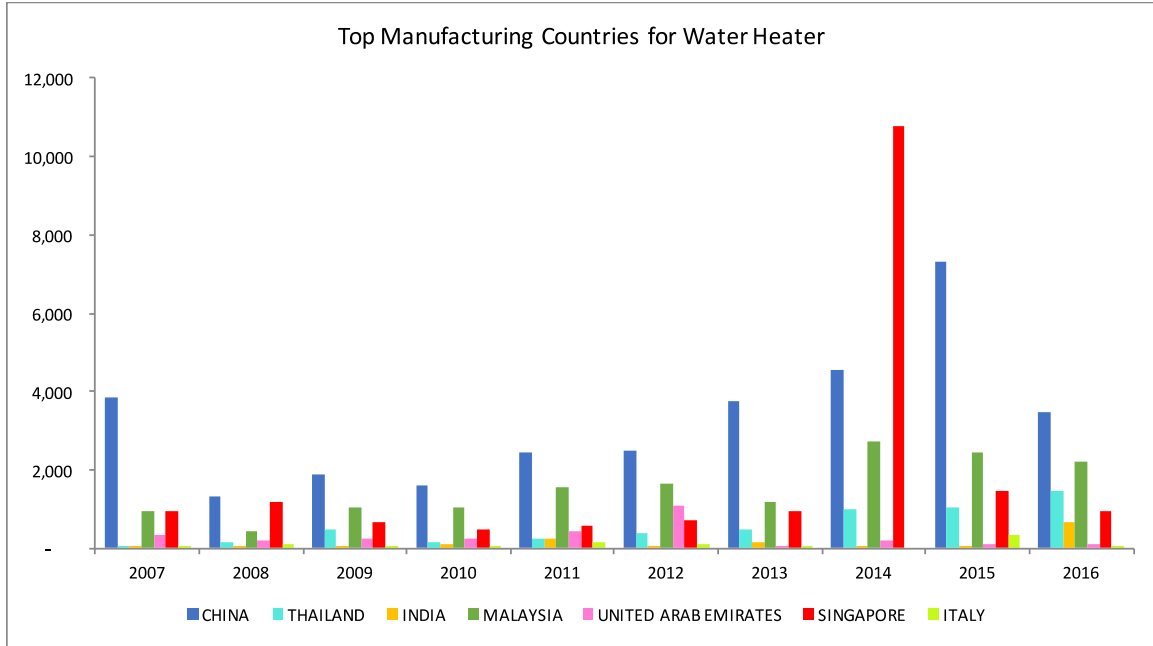


Figure 11.3 Main countries of manufacture origin

11.6. Imports by Country of Shipping

Majority of the water heaters are shipped from UAE, who are closely followed by Singapore as seen in Figure 11.4 below. It can also be seen that an overwhelming large quantity of water heaters were shipped from Singapore in 2014. The same year similar quantities of water heaters manufactured in Singapore were also imported.

Singapore is the top country of shipping for water heaters imported to the Maldives in 2016, with 39%, followed by, UAE (22%), Thailand (7%), Malaysia (5%) and China (4%).

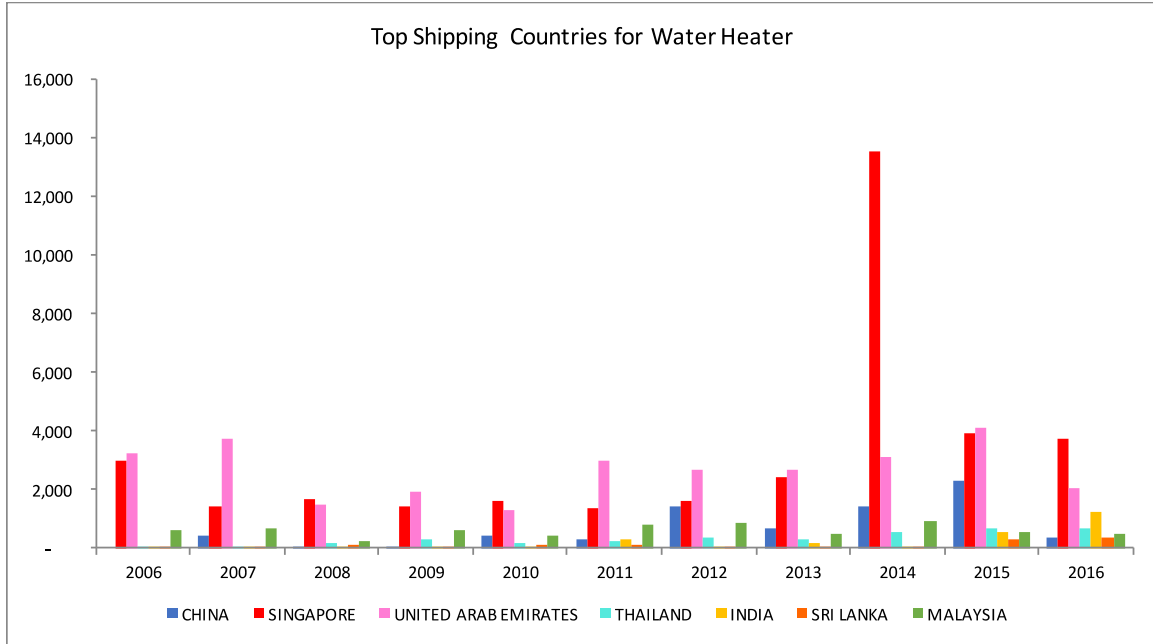


Figure 11.4 Proportion of water heaters imported by country of shipping

11.7. Types of Water Heaters

11.7.1. Electric instantaneous

Water heaters include storage type units that store heated water in an insulated tank and instantaneous type units that heat water on demand. Instantaneous is the major type in market.

11.7.2. Inverter type

A total of 23 different models of water heaters were found across 7 different shops. Among the water heater models, 7 were found to be inverter type.

11.7.3. Different sizes of water heaters

Most products are instantaneous electric water heaters.

11.8. Energy Consumption

Annual energy consumption for water heaters between 300 - 1000kWh/year. The following assumptions were made when calculating the annual energy consumption values for the models explored in the study: Average annual usage is 2/3rd of the year, 240 days and water heaters are used 1 hour per day on average.

Among the models explored there were water heaters with the annual energy consumption values as low as 292kWh to as high as 1,095kWh.

The water heaters with the lowest annual energy consumption value, 292kWh are Ariston brand water heaters of capacity 10L (BLU R 10V) to 15 (BLU R 15V) and they are manufactured in China and shipped from United Arab Emirates.

Water heaters with the highest energy consumption value, 1,095kWh are Hitachi brand water heaters (HES-45VY) with water pressure between 15.69kPa to 343.23kPa.

11.9. Quantity Forecasted

Water heater imports forecasted to reach 20,000 by 2025. Water heaters are forecasted to have steady growth and will add to the existing stock of water heaters. The apartment style living and the increase in air-conditioning are likely to lead to higher use of instantaneous electric water heaters.

The instantaneous electric water heaters that heat water on demand has relatively very high annual energy consumption for very short duration of product use. There are several alternative technologies that have been tested and in use in the Maldives for heating water. These technologies include solar water heaters and air-conditioner waste heat recovery.

It is recommended that MEE develop an energy efficiency policy for water heaters and promote the use of alternative more efficient technologies through price incentivisation.

12. WATER PUMPS

12.1. Monetary Value of Imports

MVR 93.7 million worth water pumps were imported in 2016. A significant growth in CIF value of water pumps since 2013. The CIF value of water pumps imported annually was steady between MVR 40 and 60 million between the period 2006 to 2013. The CIF value of imported water pumps has risen from MVR 55.9 million in 2013 to 93.7 million in 2016.

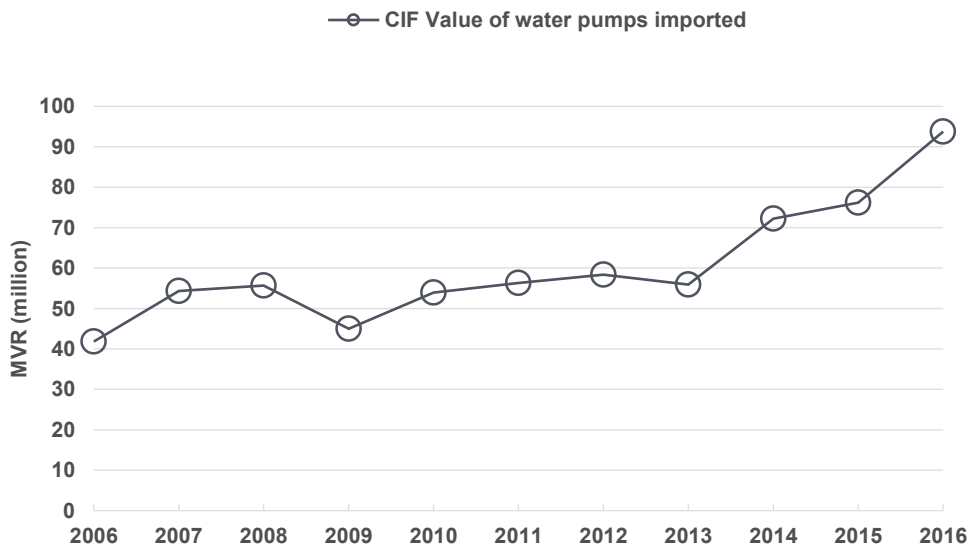


Figure 12.0 CIF value of water pumps imported in MVR (million) from 2006-2016

12.2. Number of Units Imported

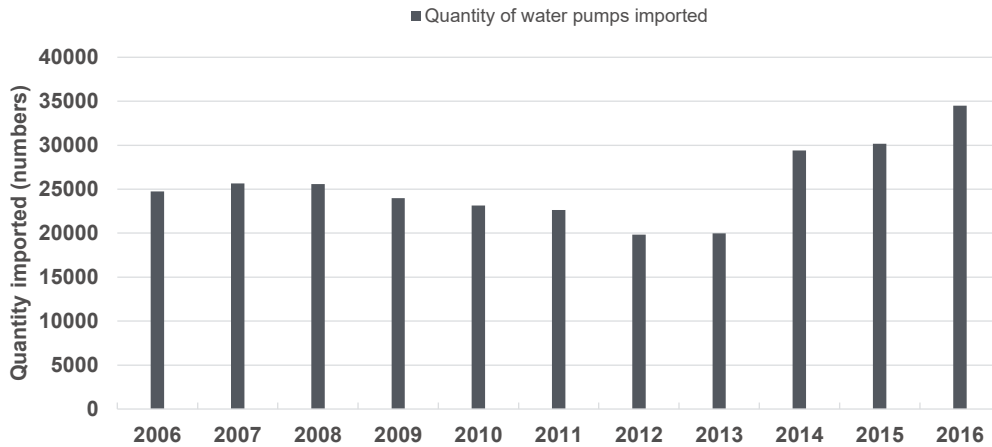


Figure 12.1 Quantity of water pumps imported by 2006-2016

Number of water pumps imported increased over last 3 years. The number of units of water pumps imported to the Maldives annually remained around 25,000 units until 2012 when it dropped to 20,000 and then had a big jump from 19,973 in 2013 to 29,386 in 2014. Since then there has been an increase reaching 34,493 in 2016. Quantity of water pumps imported over the past ten years increased from 24,750 in 2006 to 34,493 in 2016.

12.3. Major Importers

Results of the 10 years data revealed that the top importers of water heaters are Lily Enterprises Private Limited, Sonee Hardware, STO, Damas Hardware and D Blue Marine. Top importers of water heaters for each from 2006 to 2016 are attached in Annex J.

Ten companies imported 86% of water pumps in 2016. STO is the leading importer of water pumps and accounted for 37% of imports in 2016. Sparks and Sony Hardware are the second and third largest importers with 5% and 4% respectively. STO is the top importer of water pumps. See Figure 12.2 below for the top importers of water heaters in 2016.

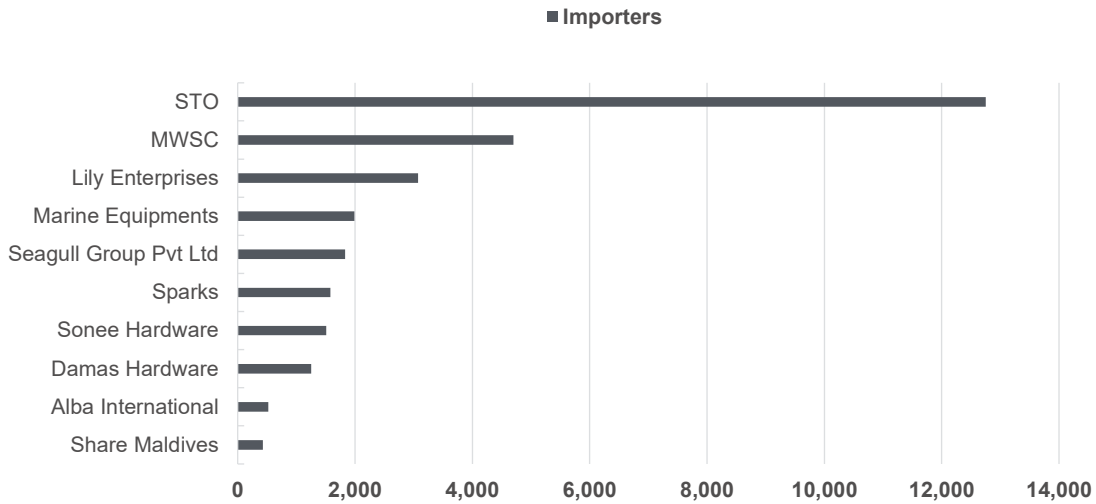


Figure 12.2 Major importers of water pumps in 2016

Ten companies imported 86% of water pumps in 2016. STO is the leading importer of water pumps and accounted for 37% of imports in 2016. Sparks and Sony Hardware are the second and third largest importers with 5% and 4% respectively. STO is the top importer of water pumps.

12.4. Brands in the Market

About six brands of water pumps were sold in by the top importers in 2016. The brands include Hitachi, Calpeda, Panasonic, Grundfos, Lowara and Davey. Table 12.0 below shows brands of water pumps sold by the top importers in 2016.

Brand	Importer
Hitachi	STO
Marquis	Sonee Hardware
Davey	Sparks
Calpeda	Alba International

Grundfos	MWSC
Lowara	MWSC

Table 12.0 Top brands and importers of water pumps

12.5. Imports by Country of Manufacture

Water pumps manufactured in China, Thailand and South Korea are mostly imported to Maldives from 2007 to 2016. As seen in Figure 12.3 below, a few manufactured in Indonesia, Australia, United States and Italy were also imported.

The leading country of manufacture for water pumps imported to the Maldives in 2016 was China (10%). The second highest quantity is from South Korea 7%, followed by Thailand (4%).

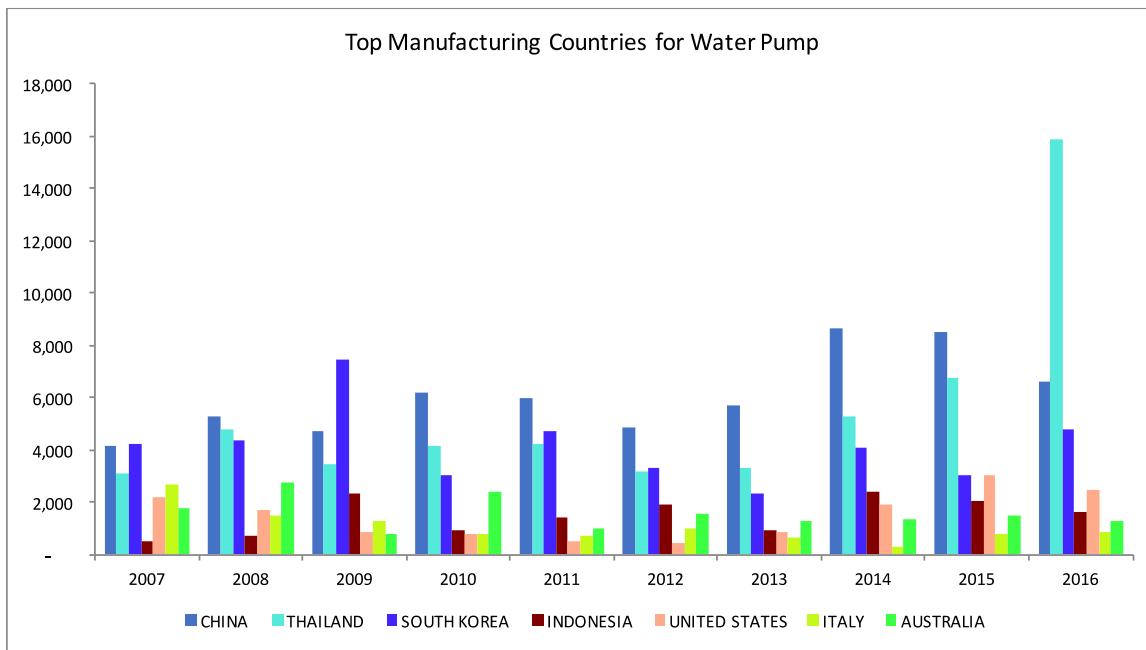


Figure 12.3 Main countries of manufacture origin

12.6. Imports by Country of Shipping

Data analysed for the past 10 years revealed that water pumps are shipped to Maldives from a variety of countries. As seen in Figure 12.4 below, top countries of shipping include, Singapore, China, South Korea, UAE and Thailand.

Thailand is the top country of shipping for water pumps imported to the Maldives in 2016, with 17%, followed by Hong Kong (13%), Singapore (10%), China (10%), UAE (9%) and South Korea (9%).

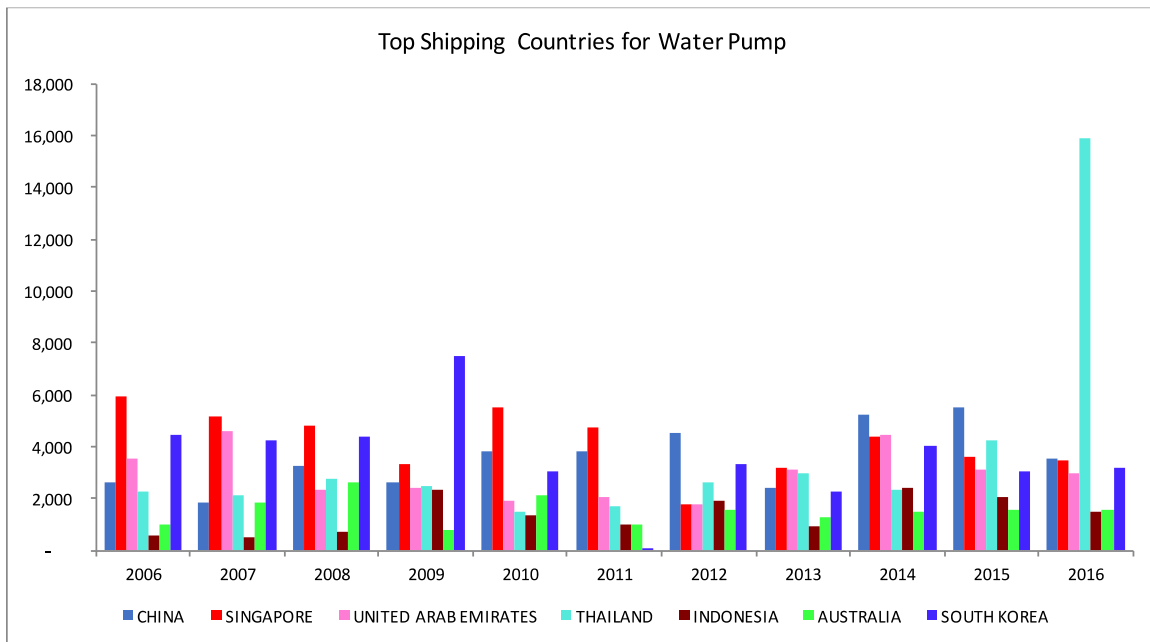


Figure 12.4 Proportion of water pump imports by country of shipping

12.7. Energy Consumption

Annual energy consumption for water pumps is between 100 and 800 kWh/year. The following assumptions were made when calculating the annual energy consumption values for the models explored in the study: Water pumps will operate for 3 hours per day on average.

Among the models explored, water pump of capacity of 1,500L per hour had the lowest annual energy consumption value of 109.5kWh. This was a Hitachi brand

(WTP100GX2) water pump imported from Thailand.

Water pump with the highest energy consumption value was one with 3,000 L per hour with 821.25kWh. This was a Marquis brand (MQS438) water pump was imported from China.

12.8. Quantity Forecasted

Water pump imports forecasted to be around 40,000 by 2025. Electric motors convert electrical energy to rotating mechanical energy to drive water pumps. Pumps contain motors and the system boundaries depend on whether the pump and motor are integrated: where the motor can be removed and tested separately, the pump and motor are considered separate products; otherwise, the pump and motor are considered an integral product. For motors, all test methods are likely to give results that at a macro-level are very similar and any differences can be negligible.

Pumps are all tested to ISO9906. Where pumps are tested with their driving motor, the efficiency values will be shaped by the combination of pump efficiency and motor efficiency, both of which vary with size but in different ways. The results of pumps tested with and without their motors cannot be compared. Given that pumps are all tested using the same ISO test procedure, and use the same efficiency metric, energy performance requirements are fairly comparable between products.

In this context, it is recommended that water pumps be considered for energy efficiency regulating in a later stage.

13. ELECTRIC FANS

13.1. Monetary Value of Imports

MVR 47.7 million worth fans were imported in 2016. An increasing trend in CIF value of fans observed since 2013. The CIF value of fans imported to the Maldives remained stable from 2006 until 2013, and there is an increasing trend since then. The CIF value has increased from MVR 25.91 million in 2013 to 47.7 million in 2016.

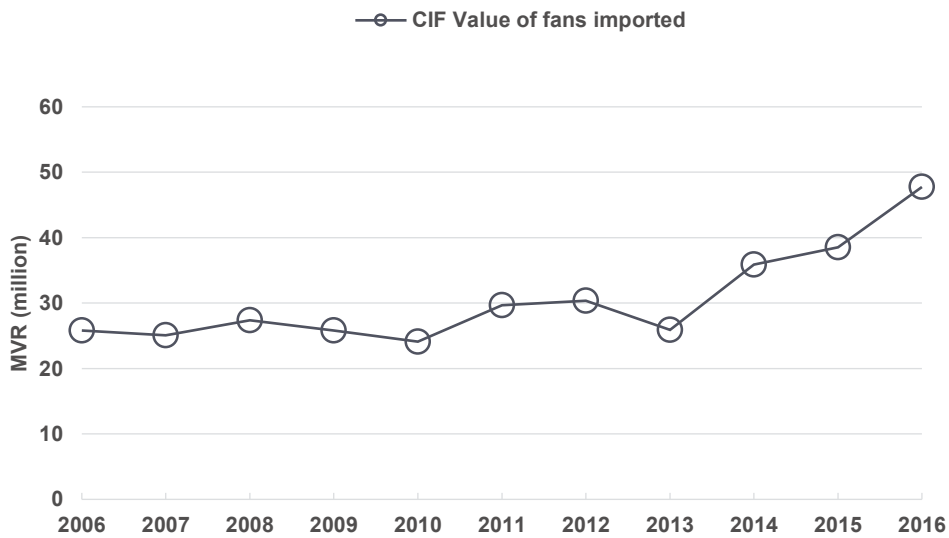


Figure 13.0 CIF value of fans imported in MVR (million) from 2006-2016

13.2. Number of Units Imported

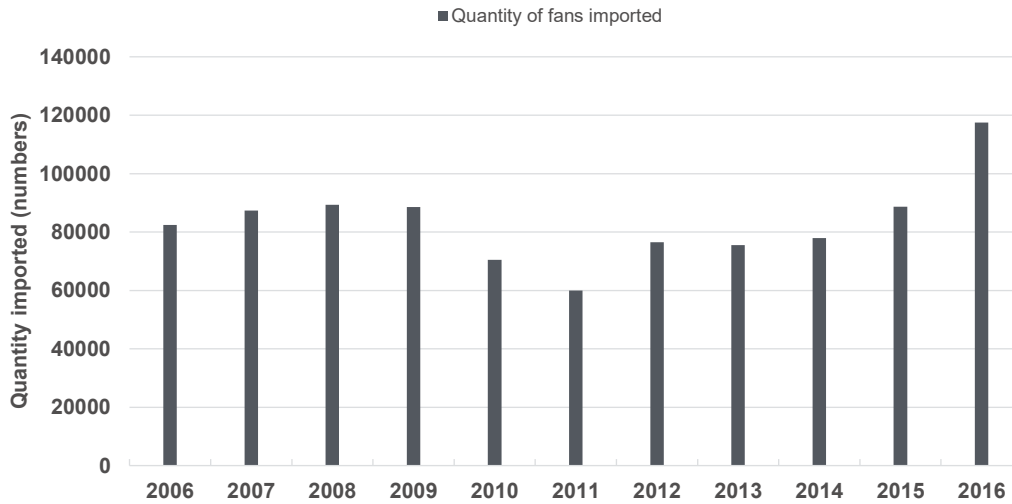


Figure 13.1 Quantity of fans imported from 2006-2016

Number of fans imported annually has increased over ten years. The number of fans imported to the Maldives shows a steady growth until the year 2009. In 2011, the annual quantity dropped and then picked up the trend again in 2012. The largest annual increase occurred in 2016.

Quantity of fans imported over the past ten years increased from 82,467 in 2006 to 117,463 in 2016.

13.3. Major Importers

Sonee Hardware is the number one importer of fans to every year from 2006 to 2016. Other top importers include AH Brothers, Sun Front, Tep-Construction and Steel hardware. Top importers of fans for each year is presented in Annex K.

Sonee Hardware imported 22% of fans imported to the country in 2016. Other major importers in 2016 are Power Engineering Trade (10.3%) Sun Front (6%), Share Maldives (5%) and AH Brothers (4%). Figure 13.2 below shows the top importers of fans in 2016.

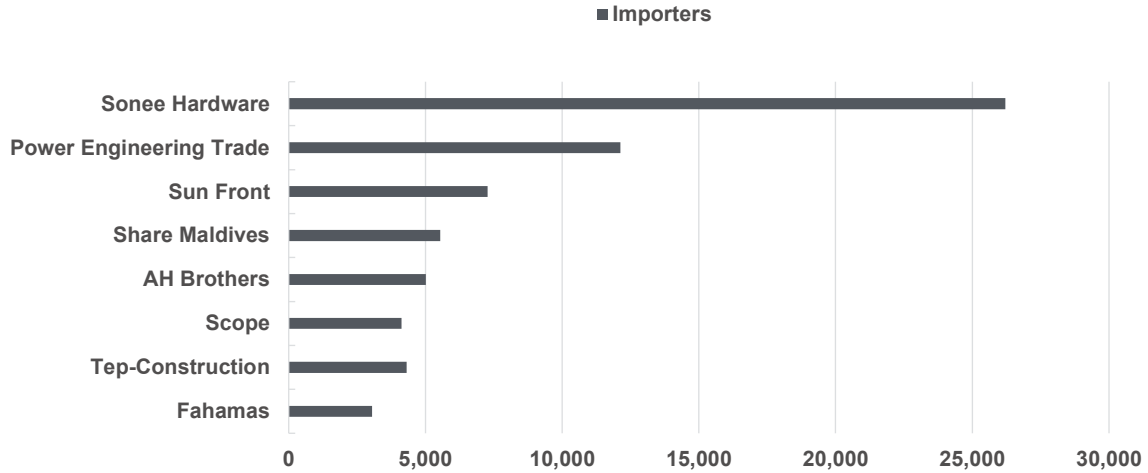


Figure 13.2 Quantity of fans imported from 2006-2016

13.4. Brands in the Market

About six brands of fans were sold by the top importers of 2016. The brands include Panasonic, Usha, Orient, Ked Brooke, KDK and Khind. Table 13.0 below shows the brands of fans sold by the top importers in 2016.

Brands	Importers
Orient	Sonee Hardware, Tep Construction
KDK	Sun Front, Tep Construction
Usha	AH Brothers
Khind	Fahams
Ked Brooke	Top Construction
Panasonic	Tep Construction

Table 13.0 Top brands and importers of fans

13.5. Imports by Country of Manufacture

An overwhelming quantity of fans imported to Maldives is manufactured in India. As seen in Figure 13.3 below, India is followed by China. A few number of fans manufactured in Singapore and Malaysia were also imported.

Most of the fans imported to the Maldives in 2016 were manufactured in China (40%) and India (38%).

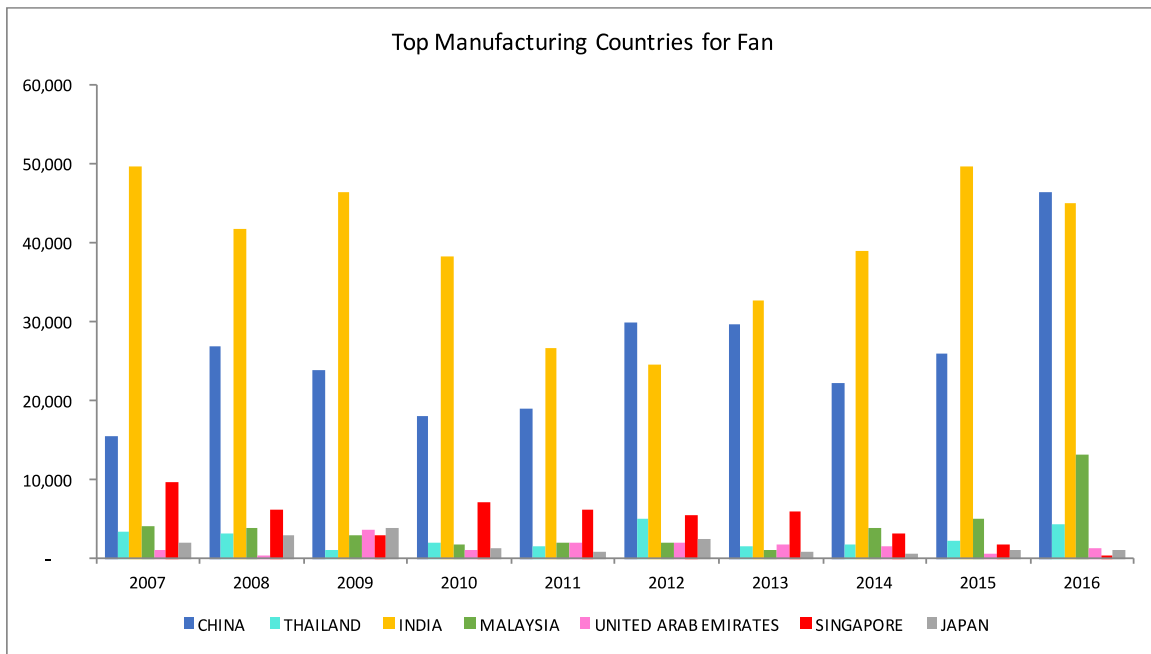


Figure 13.3 Main countries of manufacture origin

13.6. Imports by Country of Shipping

Majority of the fans imported to Maldives are shipped from India. As seen in Figure 13.4, other top countries of shipping include China, Singapore, UAE, Thailand and Malaysia.

India is the top country of shipping for fans imported to the Maldives in 2016 with 36%, followed by China (24%), UAE (13%), Singapore (12%) and Hong Kong (4%). Every one out of three fans imported to Maldives in 2016 was shipped from India.

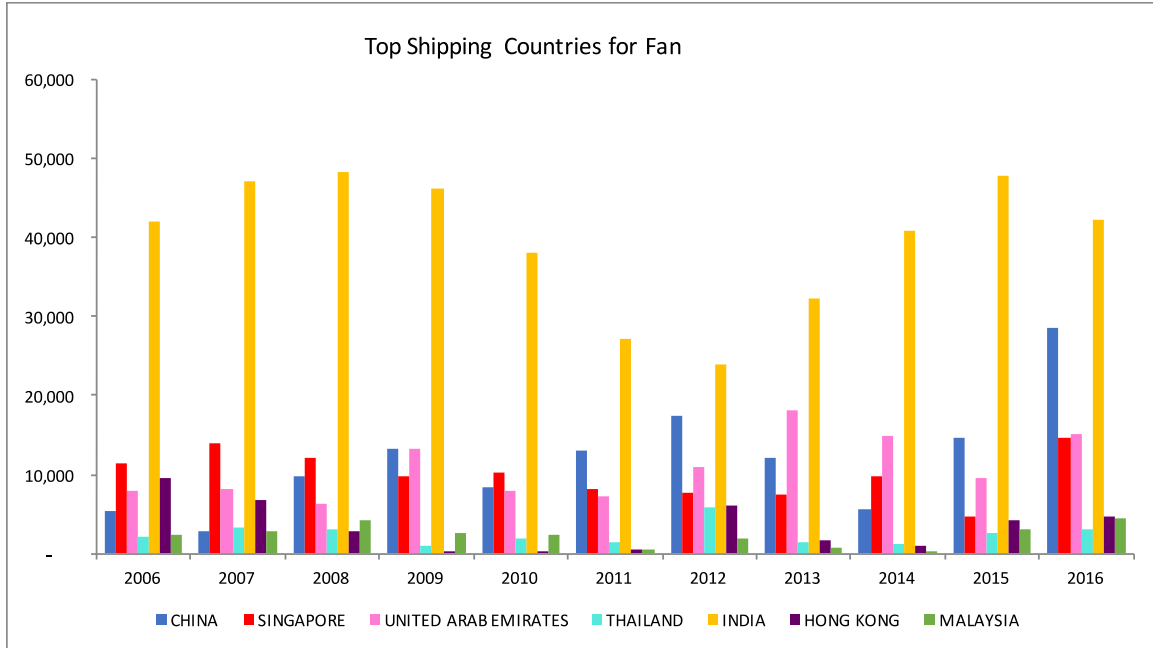


Figure 13.4 Proportion of fan imports by country of shipping

13.7. Energy Consumption

The following assumptions were made when calculating the annual energy consumption values for the models explored in the study: Fans are used 12 hours a day on average and 90% throughout the year.

Among the models explored in the retailer market, the annual energy consumption value of fans ranged from a low of 216kWh to a high of 256.23kWh. Both models were of Nikai brand and imported from China.

13.8. Quantity Forecasted

Electric fan imports forecasted to be around 100,000 by 2025. There is a substantially large existing stock of fans in the Maldives. The electric fans import forecast is stable and will be around 100,000 by 2025. Hulhumale’ apartment development will lead to a significant increase in electric fans imported.

For fans, ISO5801 is the universally accepted global test standard. ISO12759

provides the technical basis for efficiency metrics of MEPS for fans. A large quantity of fans in the market is imported from India and they have an energy efficiency standard and labeling scheme.

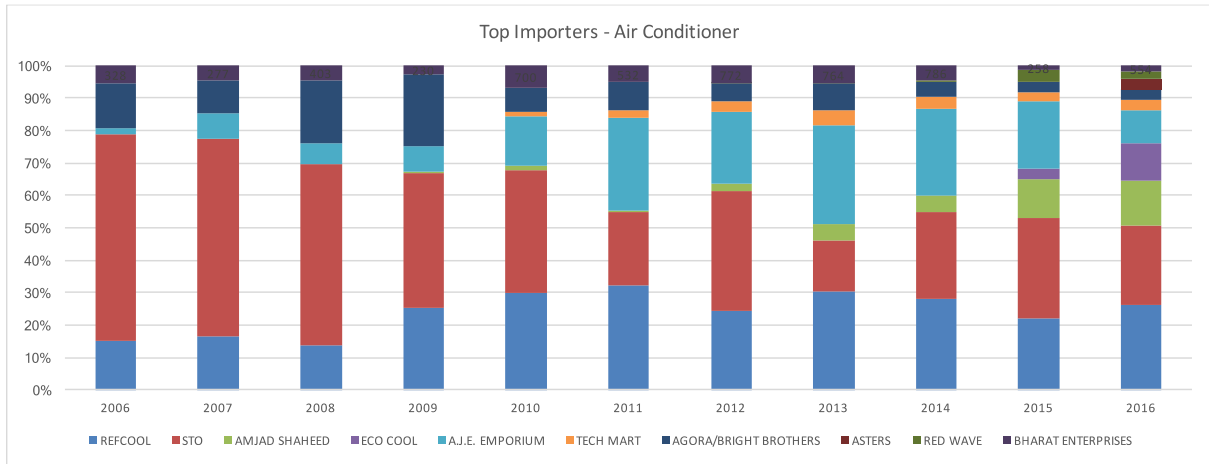
According to the study published by CLASP and The Policy Partners in 2014 on Improving Global Comparability of Appliance Energy Efficiency Labels and Standards, energy performance levels of fans are somewhat comparable between countries. Many countries have just started to regulate fans, and there are only a few regulations in place for fans.

In this context, it is recommended that electric fans be regulated for energy efficiency labeling and standards in a later stage.

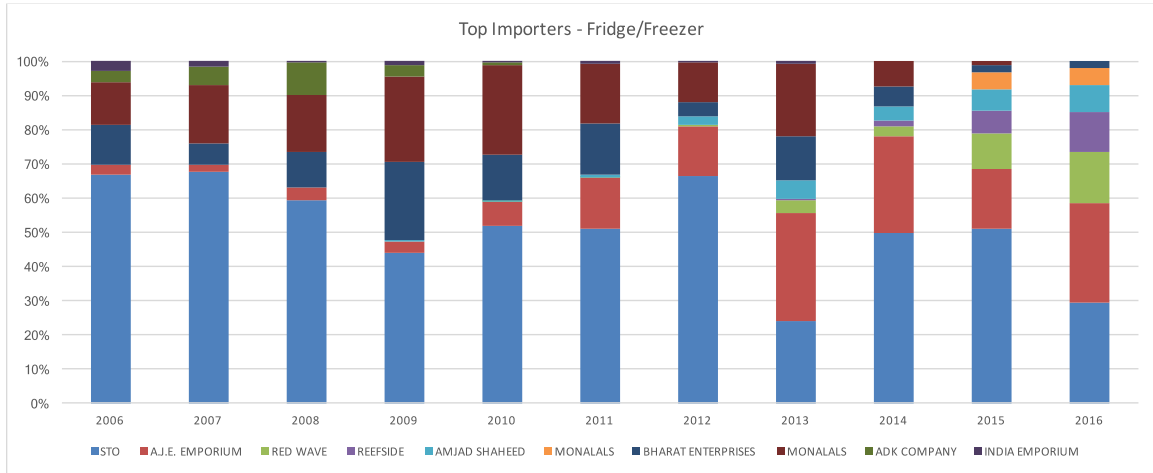
Annex A – List of HS Codes used for the study

CODE	HS DESCRIPTION	Selection	Group
8413810012	Water Pumps	Yes	WATER PUMP
8413811013	Water Pump	Yes	WATER PUMP
8414510000	Table, Floor, Wall... Fans, With Self-Contained Electric Motor <=125W	Yes	FAN
8414590010	Fan (Of Output Exceeding 125W)	Yes	FAN
8414590011	Exhaust Fan & Ventilators	Yes	FAN
8414599011	Ventilator And Exhaust Fan	Yes	FAN
8415100000	Window Or Wall Air Conditioning Machines, Self-Contained	Yes	AIR CONDITIONER
8415810000	Air Conditioning Machines, With Refrigerating Unit And Valve	Yes	AIR CONDITIONER
8415820000	Air Conditioning Machines, With Refrigerating Unit, No Valve	Yes	AIR CONDITIONER
8418100000	Combined Refrigerators-Freezers, With Separate External Doors	Yes	REFRIGERATOR/FREEZER
8418210000	Compression-Type Household Refrigerators	Yes	REFRIGERATOR/FREEZER
8418290010	Refrigerator (Household) Other	Yes	REFRIGERATOR/FREEZER
8418290012	Refrigerator (Household) Absorption Type.	Yes	REFRIGERATOR/FREEZER
8418300000	Freezers Of The Chest Type, Capacity =<800Litres	Yes	REFRIGERATOR/FREEZER
8418400010	Deep Freezer Of Upright Type=<900 Ltrs	Yes	REFRIGERATOR/FREEZER
8450110000	Fully-Automatic Washing Machines, Capacity=<10Kg	Yes	WASHING MACHINE
8450120000	Washing Machines With Built-In Centrifugal Drier, Capacity =<10Kg	Yes	WASHING MACHINE
8450190000	Washing Machines, Nes, Of A Dry Linen Capacity =<10Kg	Yes	WASHING MACHINE
8516101011	Water Heater For Storage (Domestic)	Yes	WATER HEATER
8516101099	Electric Instantaneous Water Heaters (Domestic),Nes	Yes	WATER HEATER
8516109099	Electric Instantaneous Water Heaters, Nes	Yes	WATER HEATER
8516500000	Microwave Ovens	Yes	OVEN
8516600016	Oven Electric (Domestic)	Yes	OVEN
8528120011	Tv (Colour)	Yes	TV
8528120012	Tv Combined With Video (Colour)	Yes	TV
8528120013	Tv Combined With Video Cd Player	Yes	TV
8528720010	Tv (Colour).	Yes	TV
8528720011	Tv Combined With Video Or Video Cd Player (Colour).	Yes	TV
8539210000	Tungsten Halogen Filament Lamps (Excl. Ultra-Violet Or Infra-Red)	Yes	LIGHT
8539220000	Filament Lamps Of A Power =<200W And Of A Voltage >100V, Nes	Yes	LIGHT
8539291000	Filament Lamps, Nes	Yes	LIGHT

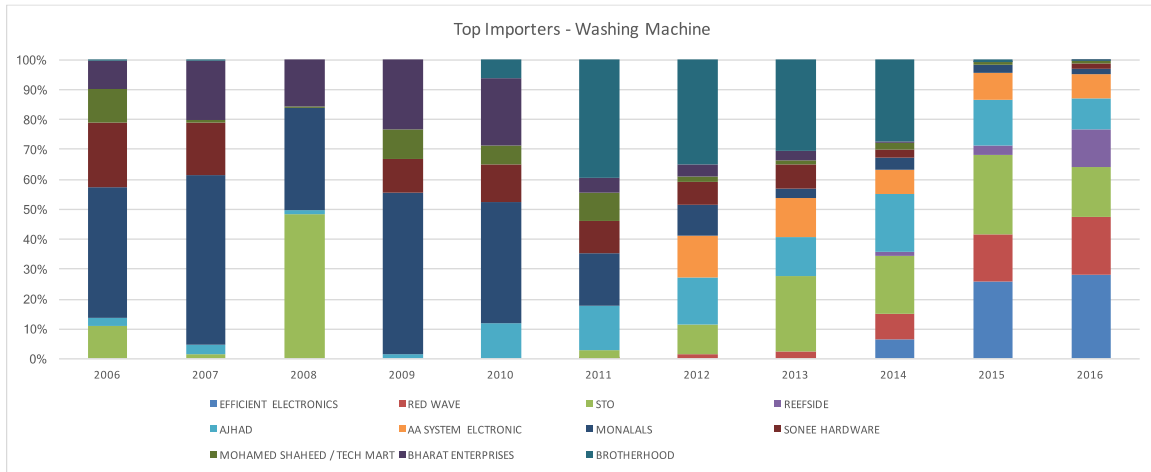
Annex B – Top Importers of Air Conditioners from 2006-2016



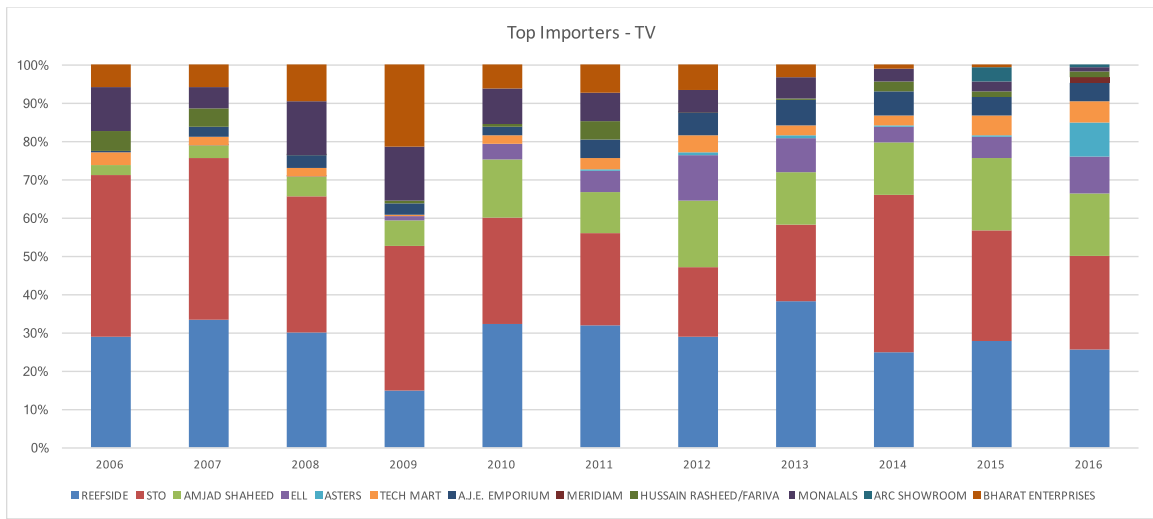
Annex C – Top Importers of Refrigerators from 2006-2016



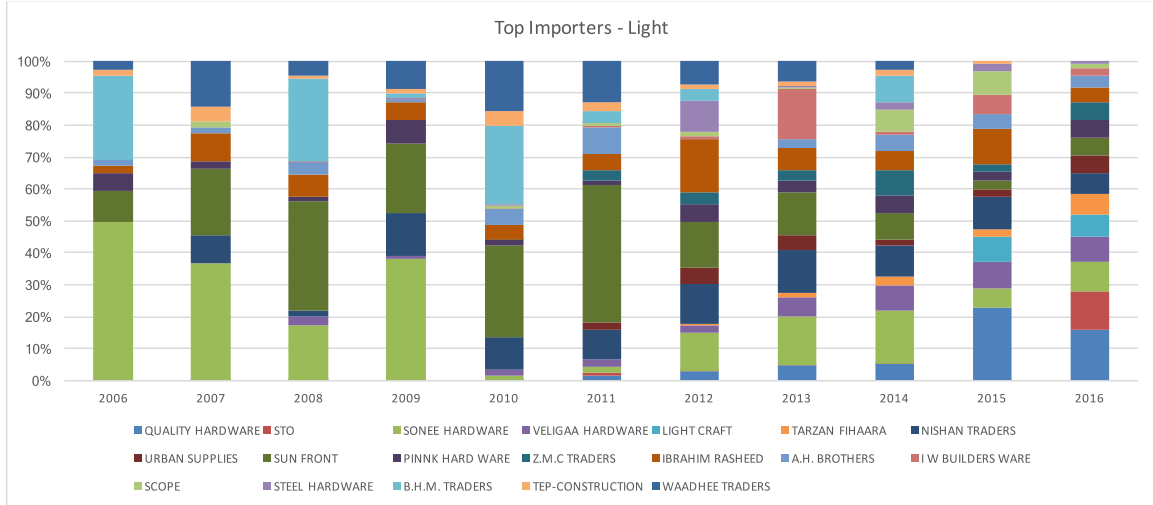
Annex D – Top Importers of Washing Machines from 2006-2016



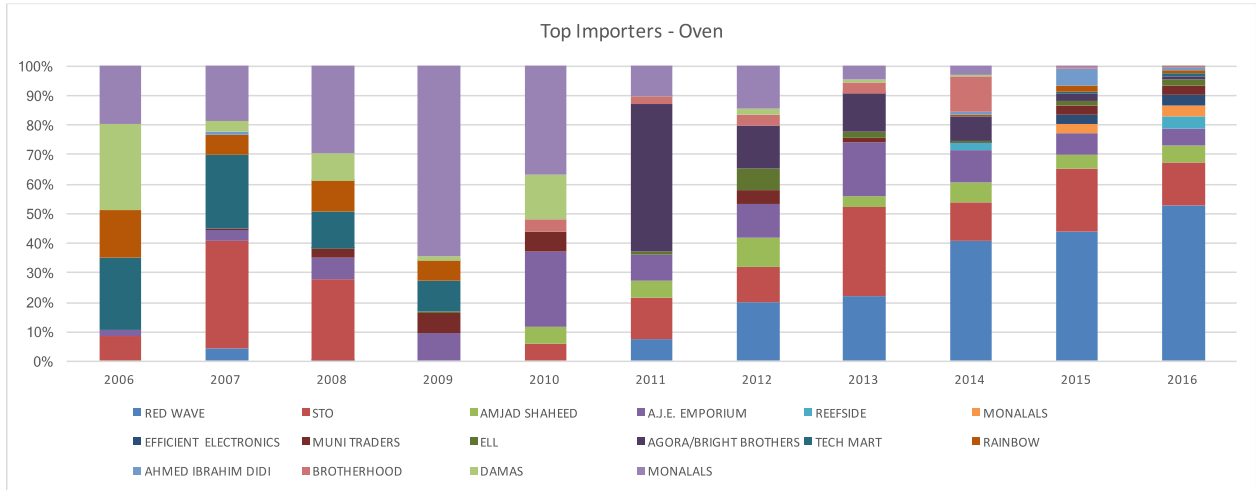
Annex E – Top Importers of Televisions from 2006-2016



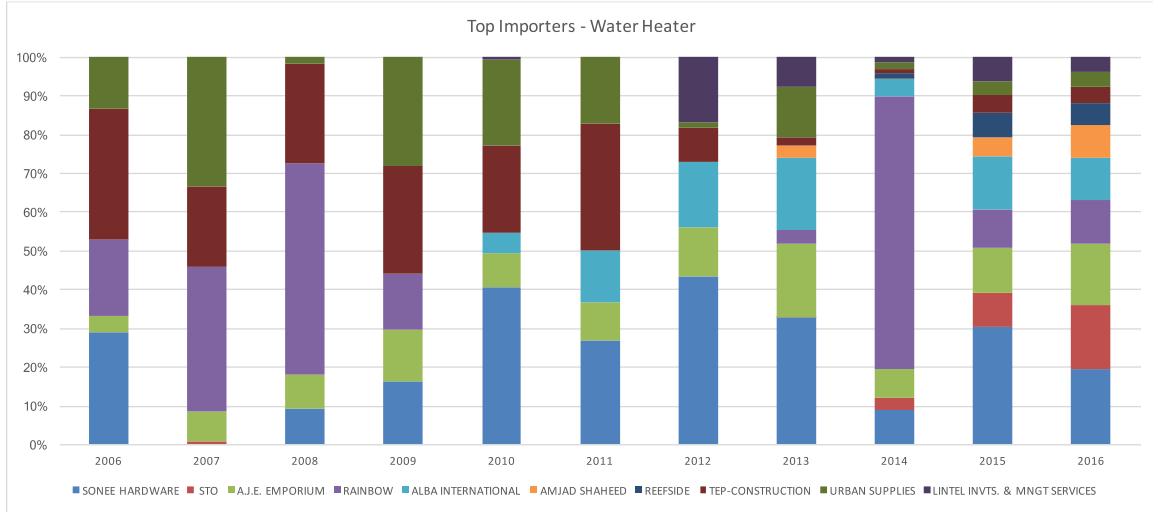
Annex F– Top Importers of Lights from 2006-2016



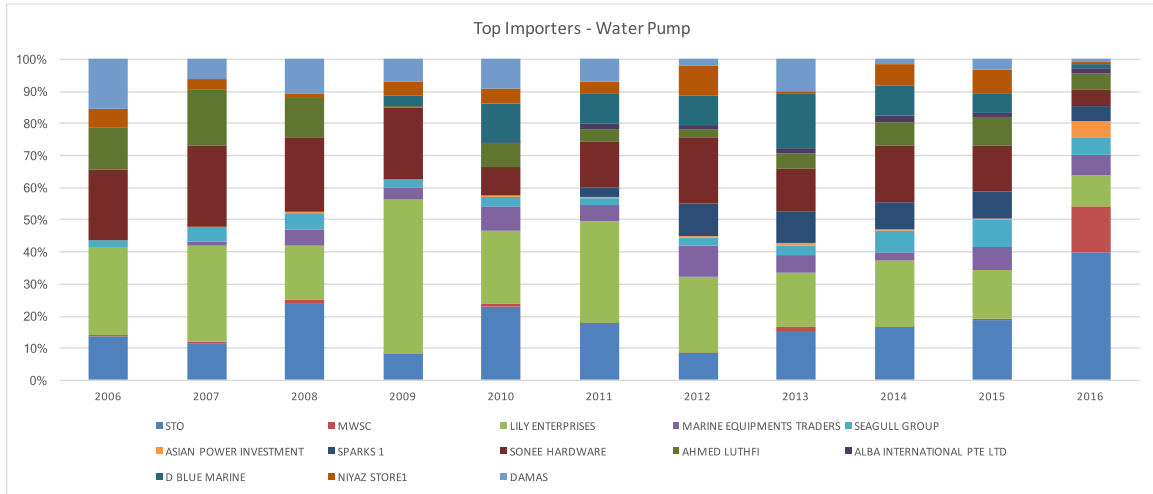
Annex G – Top Importers of Ovens from 2006-2016



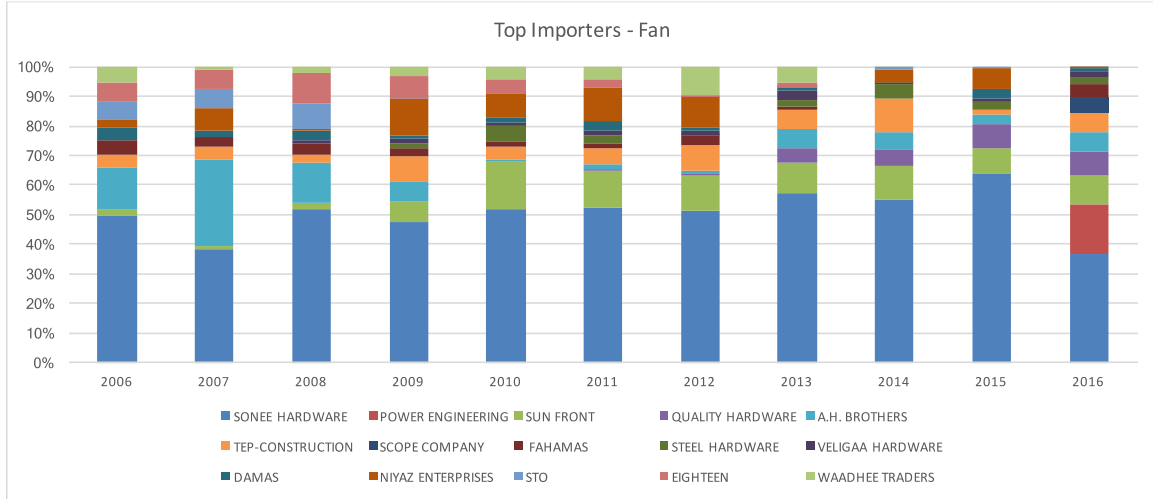
Annex H – Top Importers of Water Heaters from 2006-2016



Annex I – Top Importers of Water Pumps from 2006-2016



Annex J – Top Importers of Fans from 2006-2016



Annex L – Retailer Survey Questionnaire