

Africa Air Conditioner Market Scoping Study

Final Report

August 15, 2018

CLASP



Contents

List of Figures	1
List of Tables	2
List of Abbreviations	3
1.0 Executive Summary	4
2.0 Introduction	6
3.0 Approach & Methodology	7
3.1 Product Coverage	7
3.2 Data sources	7
3.2.1 Market Size Data	7
3.2.2 AC Characteristics and Performance Data	7
3.2.3 Limitations	7
3.2.4 Analysis of Data	7
3.2.5 Stakeholder Interview and Survey	8
4.0 Regional AC Market Overview	9
5.0 National Market Assessment – Ghana	13
5.1 Market Size	13
5.2 Market Characteristics	13
5.2.1 Data Sources	13
5.2.2 Major Brands	13
5.2.3 AC Types, Functions, Capacities, and Prices	14
5.2.4 Energy Performance	15
5.2.5 Availability of Inverter Technologies and Refrigerant Types	15
6.0 National Market Assessment – Kenya	17
6.1 Market Size	17
6.2 Market Characteristics	17
6.2.1 Data Sources	17
6.2.2 Major Brands	17
6.2.3 Capacities, Types, Functions, and Prices	18
6.2.4 Energy Performance	19
6.2.5 Availability of Inverter Technologies and Refrigerant Types	20
7.0 National Market Assessment – Mauritius	21
7.1 Market Size	21
7.2 Market Characteristics	21
7.2.1 Data Sources	21
7.2.2 Major Brands	21
7.2.3 AC Types, Functions, Capacities, and Prices	22

7.2.4	Energy Performance	23
7.2.5	Availability of Inverter Technologies and Refrigerant Types	24
8.0	National Market Assessment – Nigeria	25
8.1	Market Size	25
8.2	Market Characteristics	25
8.2.1	Data Sources	25
8.2.2	Major Brands	25
8.2.3	AC Types, Functions, Capacities, and Prices	26
8.2.4	Energy Performance	27
8.2.5	Availability of Inverter Technologies and Refrigerant Types	27
9.0	National Market Assessment – South Africa	28
9.1	Market Size	28
9.2	Market Characteristics	28
9.2.1	Data Sources	28
9.2.2	Major Brands	29
9.2.3	AC Types, Functions, Capacities, and Prices	29
9.2.4	Energy Performance	30
9.2.5	Availability of Inverter Technologies and Refrigerant Types	31
10	National Market Assessment – Tunisia	32
10.1	Market Size	32
10.2	Market Characteristics	32
10.2.1	Data Sources	32
10.2.2	Major Brands	32
10.2.3	AC Types, Functions, Capacities, and Prices	33
10.2.4	Energy Performance	34
10.2.5	Availability of Inverter Technologies and Refrigerant Types	35
11	National Market Assessment – Burkina Faso	36
12	National Market Assessment – Morocco	37
13	National Market Assessment – Senegal	38
Appendix 1:	Africa Air Conditioner Market Scoping Study Survey	38

This report has been produced by the Collaborative Labeling and Appliance Standards Program (CLASP), August 2018. Support was given by the Institute for Governance & Sustainable Development (IGSD).

CLASP makes no representations or warranties implied. The work presented in this report represents our best efforts and judgments based on the information available at the time this report was prepared. CLASP is not responsible for the reader's use of, or reliance upon, the report, nor any decisions based on the report. Readers of the report are advised that they assume all liabilities incurred by them, or third parties, as a result of their reliance on the report, or the data, information, findings and opinions contained in the report.

List of Figures

Figure 1: Price ranges for 12,000 and 24,000 Btu/hr ACs in four African markets (N=322)*	4
Figure 2: China's AC exports to Africa	9
Figure 3: AC sales in six selected African countries (2016)	9
Figure 4: Major AC brands in selected African markets	10
Figure 5: The energy performance of ACs in four African markets (N=225)	11
Figure 6: Comparative energy labels for Ghana, Kenya, Nigeria and South Africa	11
Figure 7: Market share of AC compressor types in six African markets	12
Figure 8: Market share of AC refrigerants in four African markets	12
Figure 9: Annual AC sales in Ghana	13
Figure 10: Major AC brands in Ghana (N=118)	14
Figure 11: Types of ACs in Ghana (N=118)	15
Figure 12: AC sizes in Ghana (N=118)	15
Figure 13: Average prices of different size AC units in Ghana (N=118)	15
Figure 14: Types of AC compressors in Ghana (N=118)	16
Figure 15: Annual AC sales/ imports in Kenya	17
Figure 16: Major AC brands in Kenya (N=142)	18
Figure 17: AC cooling capacities in Kenya (N=142)	18
Figure 18: Average prices of different capacity AC units in Kenya (N=142)	19
Figure 19: The energy performance of ACs in Kenya (N=29)	19
Figure 20: Types of AC compressors in Kenya (N=142)	20
Figure 21: Types of AC refrigerants in Kenya (N=142)	20
Figure 22: Annual AC sales in Mauritius	21
Figure 23: Major AC brands in Mauritius (N=112)	22
Figure 24: AC functions in Mauritius (N=12)	22
Figure 25: AC cooling capacities in Mauritius (N=112)	22
Figure 26: Average prices of different capacity AC units in Mauritius (N=112)	23
Figure 27: Energy performance of ACs in Mauritius (N=29)	23
Figure 28: Types of AC compressors in Mauritius (N=112)	24
Figure 29: Types of AC refrigerants in Mauritius (N=112)	24
Figure 30: Annual AC sales in Nigeria	25
Figure 31: Major AC brands in Nigeria (N=334)	26
Figure 32: Type of ACs in Nigeria (N=334)	26
Figure 33: AC sizes in Nigeria (N=334)	26
Figure 34: Average prices of different size AC units in Nigeria (N=334)	27
Figure 35: Types of AC compressors in Nigeria (N=334)	27
Figure 36: Annual AC sales in South Africa	28
Figure 37: Major AC brands in South Africa (N=236)	29
Figure 38: AC functions in South Africa (N=236)	30
Figure 39: AC cooling capacities in South Africa (N=236)	30
Figure 40: Average prices of capacity AC units in South Africa (N=236)	30
Figure 41: AC energy performance in South Africa (N=146)	31
Figure 42: Types of AC compressors in South Africa (N=236)	31
Figure 43: Types of AC refrigerants in South Africa (N=236)	31
Figure 44: Annual AC sales in Tunisia	32
Figure 45: Major AC brands in Tunisia (N=120)	33
Figure 46: AC functions in Tunisia (N=120)	33
Figure 47: AC cooling capacities in Tunisia (N=120)	33
Figure 48: Average prices of different capacity and different function AC units in Tunisia (N=120)	34
Figure 49: AC energy performance in Tunisia (N=51)	34
Figure 50: Types of AC compressors in Tunisia (N=120)	35
Figure 51: Types of AC refrigerants in Tunisia (N=120)	35
Figure 52: Annual AC sales in Morocco	37

List of Tables

Table 1: Current status of minimum energy performance standards in six African countries	5
Table 2: Approximate conversion from horsepower to cooling capacity assuming EER of 2.8 (W/W)	14

List of Abbreviations

AHAM	Association of Home Appliance Manufacturers
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
CC	Cooling Capacity
EER	Energy Efficiency Ratio
HP	Horsepower
IEC	International Electrotechnical Commission
IGSD	Institute for Governance & Sustainable Development
ISO	The International Organization for Standardization
JRAIA	The Japan Refrigeration and Air Conditioning Industry Association
JARN	Japan Air Conditioning, Heating & Refrigeration News
MEPS	Minimum Energy Performance Standards
MV&E	Monitoring, Verification and Enforcement
NDC	Nationally Determined Contribution
PAMS	Policy Analysis Modeling System
S&L	Standards and Labeling
SEER	Seasonal Energy Efficiency Ratio
VSD	Variable Speed Drive

01 Executive Summary

Cooling is essential to human health and prosperity and is becoming more important as the world urbanizes, economies grow, and the planet heats up. In 2017, 2.8 million room air conditioner (AC) units were sold in Africa. However, only ten African countries have appliance energy efficiency programs, leaving many others at risk of being saddled with inefficient, environmentally harmful, and poor quality ACs. Without energy efficiency standards and labeling (S&L) schemes, there is neither an obligation to report performance nor a mechanism to verify compliance of products available on the market.

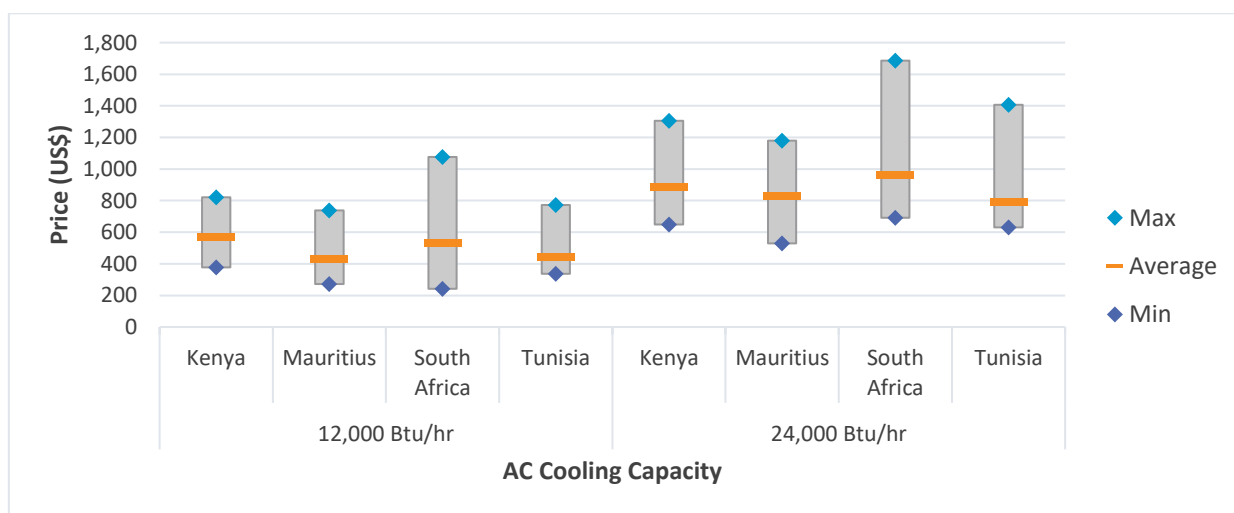
The *Africa Air Conditioner Market Scoping Study* is the result of CLASP's collection and analysis of available information on split AC and window AC products in nine key markets in Africa: Burkina Faso, Ghana, Kenya, Mauritius, Morocco, Nigeria, Senegal, South Africa, and Tunisia. Each of the nine priority countries represent one of three conditions: the largest economies in terms of AC demand from each region in Africa, countries that import all of their AC equipment (i.e. without an AC manufacturing base), and countries that have demonstrated leadership on integrating efficiency into refrigerant transition.

This report provides an initial overview of the size and characteristics of AC markets, including origin and product type, share of imports versus local manufacturing, energy performance, and refrigerants used. The primary sources of data were stakeholder interviews, industry reports, and online shops. This report relies on market size data from Euromonitor, the Japan Refrigeration and Air Conditioning Industry Association (JRAIA), and the Japan Air Conditioning, Heating and Refrigeration News (JARN). CLASP validated this data through stakeholder interviews with National Ozone Officers or local experts. CLASP collected product data, including brand name, model number, cooling capacity, energy efficiency ratings, refrigerants, country of origin, and price through a search of online retailers. However, data from online shops was only available for six countries: Tunisia, Ghana, Nigeria, Kenya, Mauritius, and South Africa.

Nigeria and South Africa are the two largest AC markets out of the six countries for which AC sales data was available, accounting for 80% of total sales (Kenya, Ghana, Tunisia, and Mauritius account for the other 20%). In most African countries, Chinese brands, like Midea, Hisense and Haier, and Korean brands, like Samsung and LG, hold the largest market share. However, there are many small competitors sharing the African market with the popular Chinese and Korean brands; in total, CLASP identified 55 unique brands in the region.

Split units are the most popular type of ACs in African markets. While 9,000, 12,000, 18,000 and 24,000 Btu/hr cooling capacities are the most common on a regional level, there is significant variation in the most popular size by country. Average prices for ACs with the most popular cooling capacities of 12,000 and 24,000 Btu/hr ranged from \$433-570 and \$789-960 respectively.

Figure 1: Price ranges for 12,000 and 24,000 Btu/hr ACs in four African markets (N=322) *



*Data available for 322 AC units.

Energy performance metrics were not available for most AC units sold in the African online shops in the six countries examined, despite all six countries having implemented S&L programs. The missing information can be explained by the lack of monitoring of online shops by regulatory agencies. Where information was available, 80% of AC units had an energy efficiency ratio (EER) between 2.8 and 3.4 W/W. The South African market had the ACs with the highest EER rating reported (>4.0 W/W), likely because of the high penetration (40% market share) of inverter ACs, which tend to have lower market share (<20%) in most African countries. Some markets, including Nigeria and Ghana, advertise horsepower instead of capacity for ACs, making comparative analysis difficult.

Table 1: Current status of minimum energy performance standards in six African countries

Minimum Energy Performance Standards (MEPS)	
Ghana	2.8 W/W
Kenya	2.8 W/W
Mauritius	No MEPS but ACs with efficiencies below Class D (<2.6 W/W) of the former EU efficiency classes attract a 25% customs levy
Nigeria	2.8 W/W (proposed) Information on the officially adopted MEPS was not available
South Africa	3.0 W/W Class B of the repealed Directive 2010/30/EU (status as at 2014; under revision)
Tunisia	3.0 W/W Class B of the former EU efficiency classes (status as at 2016 ¹)

Regarding refrigerants, while most African countries have instituted regulations to assist the phase out of HCFCs, few have regulations to control the importation of ACs that use HCFCs. Only South Africa has implemented HCFC regulations that cover AC units. In the markets studied, R-410A is the dominant refrigerant in new ACs, while new R-22 units can still be found in some markets, like Kenya and Tunisia. In South Africa, ACs using R-410A make up almost 70% of the market, while in other countries they represent between 20% and 50%, with significant shares unspecified. As countries pursue enabling activities in support of the Kigali Amendment, governments may want to consider opportunities to develop policies to avoid obsolete technologies and promote energy efficiency while transitioning to climate friendly alternatives.

The nine countries examined represent a diverse set of markets, both in size and characteristics, providing a basis for assessing AC market trends and policy needs. This market scoping study serves as an initial characterization of the African AC market. Future AC market studies may look to explore the gaps and challenges identified within this report, including insufficient reporting of energy efficiency metrics, lack of regulatory monitoring of online shops, drivers for low penetration of inverter technology, and absence of import regulations for ACs using HCFCs.

¹ Ezzedine Khalfallah, Rafik Missaoui, Samira El Khamlichi and Hassen Ben Hassine. Energy-Efficient Air Conditioning: A Case Study of the Maghreb Opportunities for a more efficient market. The World Bank Group. April 2016. <http://documents.worldbank.org/curated/en/754361472471984998/pdf/105360-REVISED-PUBLIC-MENA-Digital-Print-English-sep-2016.pdf>

02 Introduction

Electricity consumption in Sub-Saharan Africa, alone, is projected to increase fourfold in the coming decades.² Most efforts to meet growing demand have focused on building capacity for generation, transmission, and distribution, with little attention given to improving energy access through energy efficiency. Only ten African countries have appliance energy efficiency programs,³ which leaves many countries at risk of being saddled with inefficient, environmentally harmful, and poor quality appliances. Without energy efficiency standards and labeling (S&L) schemes, there is neither an obligation to report performance nor a mechanism to verify compliance of products available on the market. The lack of reliable information reinforces a vicious cycle, as there is often not enough evidence to support the development and implementation of appliance efficiency programs.

Cooling is essential to human health and prosperity and is becoming more important as the world urbanizes, economies grow, and the planet heats up. In 2017, 2.8 million room air conditioner (AC) units were sold in Africa.⁴ According to the Japan Air Conditioning, Heating and Refrigeration News (JARN), the market grew 8.3% in 2016 compared to 2015. However, AC market growth in Africa can be variable from year to year due to overall poor economic conditions and weather patterns. The major AC markets in the region are Nigeria, South Africa, Libya, Egypt, and Algeria. Africa imports most, if not all, AC units or components, primarily from China and South Korea. However, some countries like Nigeria and Egypt have in-country AC assembly plants of major brands like Samsung and LG.

This study analyzed available information on AC products in nine key markets in Africa: Burkina Faso, Ghana, Kenya, Mauritius, Morocco, Nigeria, Senegal, South Africa, and Tunisia. These priority countries represent one of three conditions: the largest economies in terms of AC demand from each region in Africa, countries that import all their AC equipment (i.e., without an AC manufacturing base) and countries that have demonstrated leadership on integrating energy efficiency into the refrigerant transition. The report provides an initial overview of the size and characteristics of AC markets, including origin and product type, share of imports versus local manufacturing, energy performance, and refrigerants used. The primary sources of data for AC product information were stakeholder interviews, industry reports, and online shops. This report serves as an initial characterization of the African AC markets and identifies gaps to target future AC market studies.

² Antonio Castellano, Adam Kendall, Mikhail Nikomarov, and Tarryn Swemmer. *Powering Africa*. February 2015. <https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/powering-africa>

³ CLASP's S&L database.

⁴ Japan Air Conditioner Heating and Refrigeration News (JARN). *World Air Conditioner Markets*. January 2018.

03 Approach & Methodology

3.1 Product Coverage

This scoping exercise covered two of the most popular room ACs: split ACs and window ACs. Portable and packaged ACs were not included in this study.

3.2 Data sources

3.2.1 Market Size Data

Market size data comes from three primary sources: Euromonitor, the Japan Refrigeration and Air Conditioning Industry Association (JRAIA),⁵ and the Japan Air Conditioning, Heating and Refrigeration News (JARN). Euromonitor provides market size estimates for both split and window ACs and provides market growth estimates for the next five years. JRAIA collects data from its member companies and provides data on window, split and packaged ACs. However, data on African markets are only available for a few major countries like Nigeria, South Africa, Morocco, Ghana, and Tunisia. JARN also collects market data for major markets like Nigeria and South Africa. Where possible, CLASP compared the data from these three sources.

3.2.2 AC Characteristics and Performance Data

The primary source of product data was online shops in each country. The online search focused on nine (9) countries: Ghana, Kenya, Mauritius, Nigeria, South Africa, Tunisia, Burkina Faso, Morocco and Senegal. However, data from online shops was only available for six (6): Ghana, Kenya, Mauritius, Nigeria, South Africa and Tunisia. Where possible, data from several online shops was collected and analyzed. In Nigeria, there were more than 300 products listed in one online shop and therefore this was the only source of product data.

Product data collected included the brand name, model number, cooling capacity, energy efficiency rating, refrigerant type, country of origin, and price. When a model appeared in multiple online shops, the duplicates were not removed in order to provide an indication of the most popular brands and types.

3.2.3 Limitations

Although online shops in six out of the nine countries listed ACs, the majority of the population in these countries most likely purchase electronic appliances, including ACs, from physical stores. The data collected from these online stores may not be representative of the overall AC market. In most cases, regulators do not monitor online stores, as online sales are less popular. The lack of energy performance data in online stores in countries with well-established S&L programs is not an indicator of consumers' awareness of energy labelling programs or the relevance of energy efficient ACs in their purchasing decisions.

3.2.4 Analysis of Data

The analysis of the product data collected focused on answering the following questions:

- Which are the major AC brands available in the market?
- Who are the major trading partners in the region (i.e., what is the origin of ACs imported to markets in Africa)?
- What are the AC market characteristics in terms of popular sizes (cooling capacity), AC functions (cooling-only or cooling and heating), and prices?
- What are the energy performance levels in terms of Energy Efficiency Ratio (EER) or Seasonal Energy Efficiency Ratio (SEER)?
- What are the market shares of non-inverter and inverter ACs?
- What are the common types of refrigerants used?

⁵ Japan Refrigeration and Air Conditioning Industry Association (JRAIA). *World Air Conditioner Demand by Region*. May 2018.

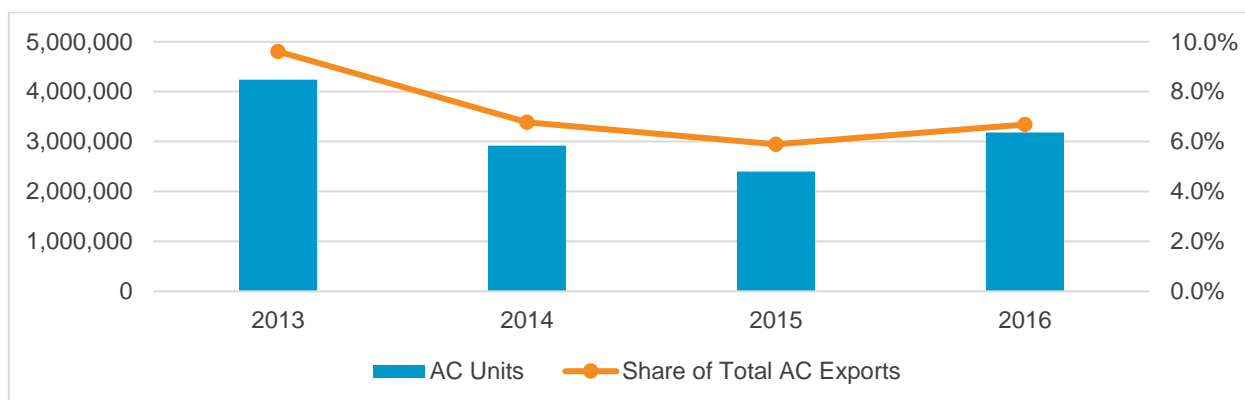
3.2.5 Stakeholder Interview and Survey

To validate the analysis of the online data, CLASP conducted stakeholder interviews with National Ozone Officers local experts in the various countries. In addition to the interview, each stakeholder was asked to fill out a survey with available data. The survey was designed to answer questions similar to those in section 3.2.4 above. The survey is attached in Appendix 1. The filled surveys were the primary data sources used to characterize the AC markets in Burkina Faso, Morocco and Senegal, since online store data was not available.

04 Regional AC Market Overview

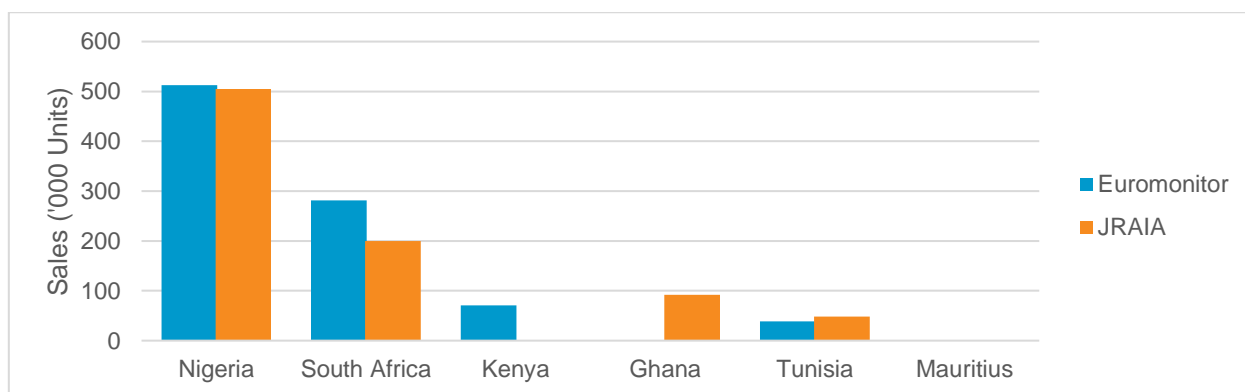
There were 2.8 million AC units sold in African markets in 2017. According to JARN, the market grew 8.3% in 2016 compared to 2015 but there was a slight decrease of 1.6% in 2017, which might have been due to overall poor economic conditions in African countries and mild summer weather.⁶ The major AC markets in the region are Nigeria, South Africa, Libya, Egypt, and Algeria. African countries import most, if not all, of their AC units and the main brands are primarily from China and South Korea. In 2016, 6.7% of all Chinese AC exports went to Africa.⁷ However, some countries like Nigeria have in-country AC assembly plants for major brands like Samsung and LG.

Figure 2: China's AC exports to Africa



Annual AC sales in 2016 according to data gathered from Euromonitor and JRAIA (where available) on the largest AC markets sampled are shown in Figure 3. Nigeria and South Africa are the largest markets, accounting for 80% of the total sales among the six countries covered by this study.

Figure 3: AC sales in six selected African countries (2016)

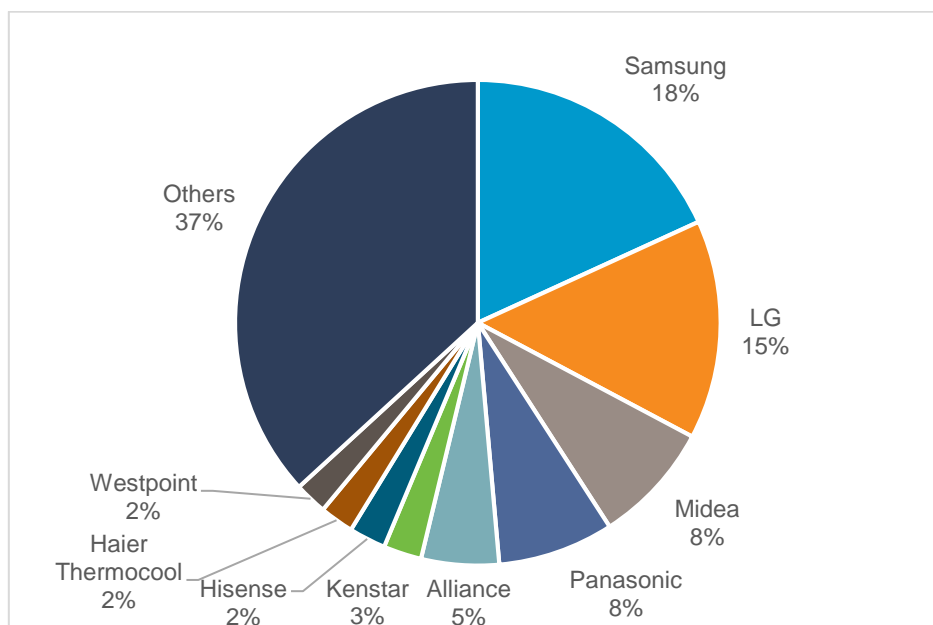


In most African countries, Chinese brands, like Midea, Hisense, and Haier, have a larger combined national market share; however, the South Korean brands Samsung and LG have the largest market share per brand (Figure 4). Out of the 1,062 products found on the online stores in the six sampled countries, 33% were Samsung and LG models. There is also significant product variety; CLASP identified 55 unique brands among the six sampled countries.

⁶ Japan Air Conditioner Heating and Refrigeration News (JARN). *World Air Conditioner Markets*. January 2018.

⁷ COMTRADE. "UN COMTRADE Database, 2015." Available online at: <https://comtrade.un.org/data/>

Figure 4: Major AC brands in selected African markets



Distribution channels vary depending on whether most ACs are imported or if foreign manufacturers have established local assembly plants. In the Kenyan and South African markets, local companies handle the importation and distribution of products, while brands with large market share like Samsung and LG have set up sales companies to promote their brands and aid in distribution. In comparison, brands like Panasonic, Shinco and Haier have established local assembly plants in Nigeria and distribute their products throughout the region.

Imported ACs enter African markets through a mixture of shipping ports and cross-border trade. In Ghana and Nigeria, although the majority of ACs enter through the ports, some products, particularly sub-standard products, are smuggled in through the borders. The main port of entry for AC imports to Kenya is the Mombasa port; however, like Ghana, some products may enter through the borders with neighboring countries like Tanzania and Somalia. Porous borders with neighboring countries serve as the main entry point for ACs in some markets, like Tunisia's, where in 2013, 80% of ACs in the market entered through this channel.

Split units are the most popular AC type in African markets. Some countries still have low penetration of window units (Ghana <3%, Nigeria <11%). In some markets (Mauritius, South Africa, and Tunisia), ACs that offer cooling and heating functions are the most popular.

The most common cooling capacities in African markets are 9,000, 12,000, 18,000, and 24,000 Btu/hr,⁸ but there is large variation in the most popular size among countries. In Tunisia, 9,000 Btu/hr units are the most popular while in South Africa 9,000, 18,000 and 24,000 Btu/hr units have an almost equal market share. In Kenya, lower capacity ACs (9,000 Btu/hr) are absent, possibly because ACs are rarely used in residential applications and instead are most commonly used in commercial applications like hotels, banking halls, and offices, among others.

In some markets (Ghana, Nigeria), capacity is not advertised and instead horsepower (HP) is used as a metric for AC sizes. Advertising only the HP in ACs can be misleading as manufacturers and retailers can sell consumers a poorly performing AC by only quoting the HP.

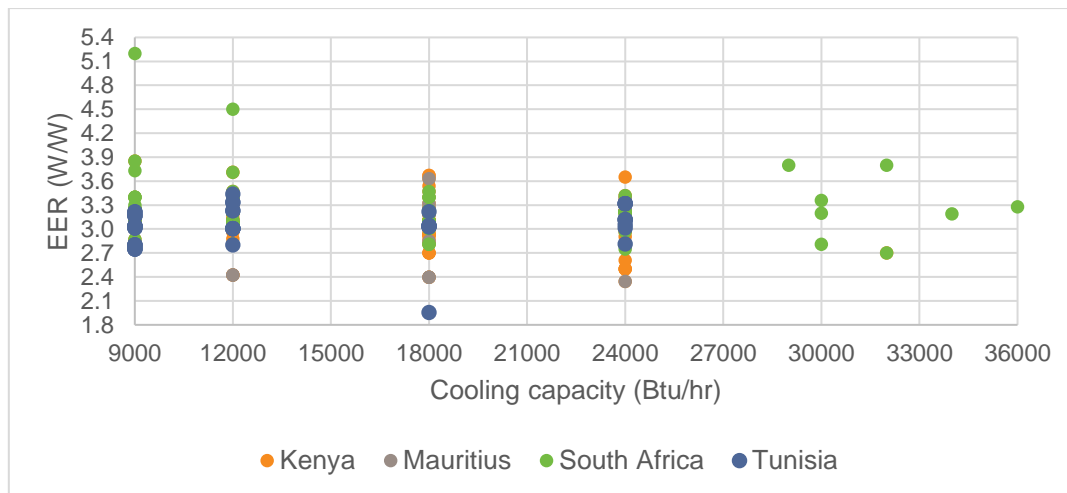
Energy performance metrics are not available for most AC units sold in African online shops, even though five out of the six countries in this study with online data have implemented S&L programs.

⁸ The approximate equivalent kilowatt (kW) capacities are: 2.6, 3.5, 5 and 7 kW respectively.

CLASP also confirmed through interviews that regulatory agencies do not currently monitor online shops, which would explain the lack of energy performance information on these websites.

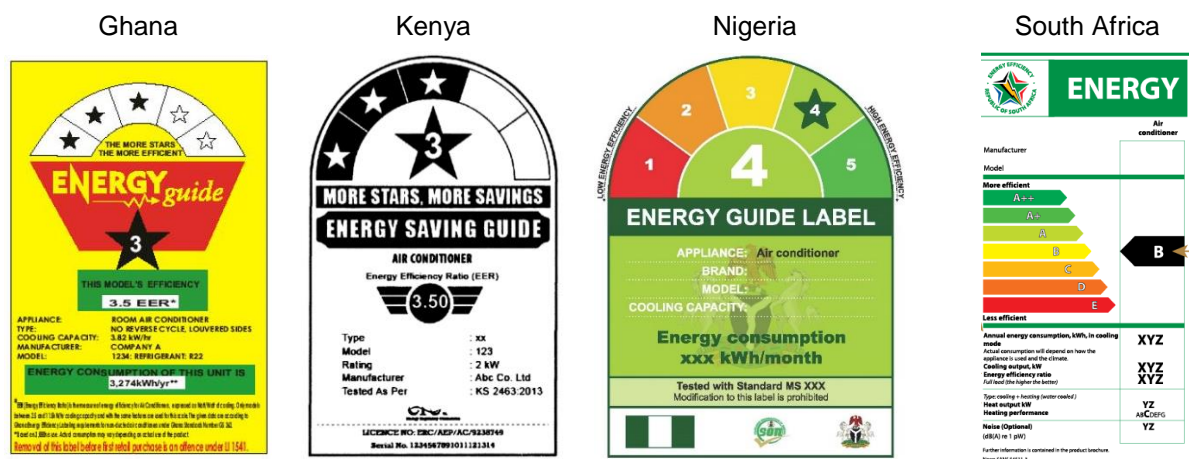
Where information was available, 80% of AC units had an energy efficiency ratio (EER) between 2.8 and 3.4 W/W (Figure 5). The South African market had the ACs with the highest EER rating reported (>4.0 W/W) likely because of the high penetration of inverter ACs.

Figure 5: The energy performance of ACs in four African markets (N=225)



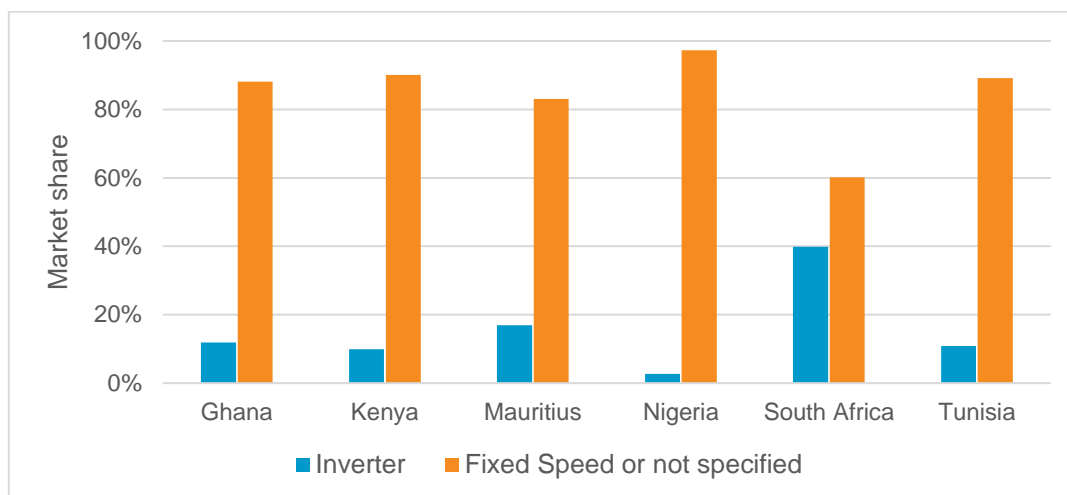
As seen in the figures below, the aforementioned energy labels that have been implemented or will be implemented in five out of the six countries evaluated for this study are all comparative, with the South African and Tunisian (not pictured) borrowing heavily from the EU label. The Ghanaian, Nigerian and Kenyan labels use a scale of 1 - 5 to indicate the level of efficiency.

Figure 6: Comparative energy labels for Ghana, Kenya, Nigeria and South Africa



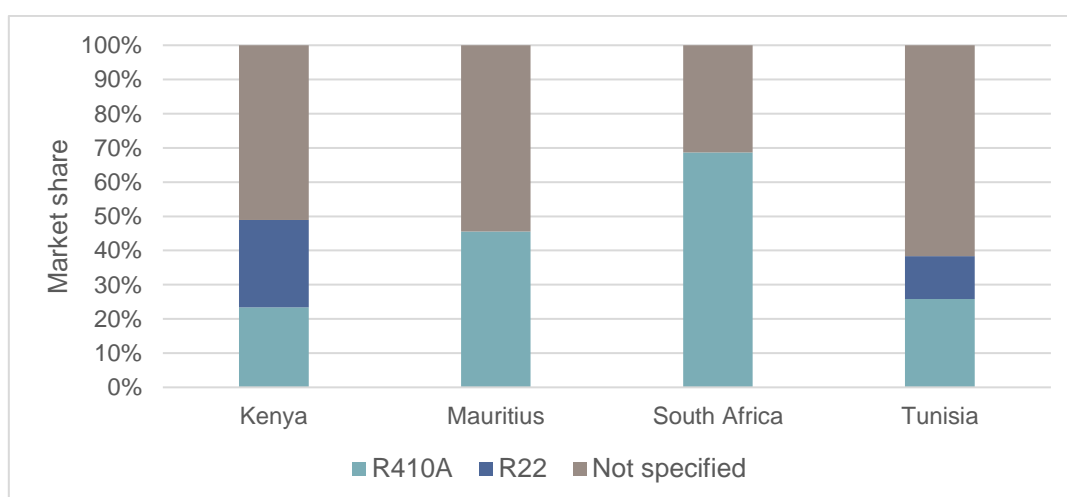
The penetration of inverter technologies is low in most African countries. There is a lack of consumer awareness on the advantages of this technology. South Africa has the highest penetration, with inverter ACs taking up 40% of the market; but in all the other countries, inverter technologies make up less than 20% of the market. Accordingly, most of the S&L programs only cover fixed speed ACs, not inverter AC technologies.

Figure 7: Market share of AC compressor types in six African markets



ACs containing HCFCs – in particular R-22 refrigerant - can still be found in some African countries, like Kenya and Tunisia. Such products have been prohibited in many developed countries. As countries pursue enabling activities in support of the Kigali Amendment, governments may want to consider opportunities to develop policies to avoid obsolete technologies and promote energy efficiency while transitioning to climate friendly alternatives. While most African countries ratified the Montreal protocol and have put in place regulations to assist the phase down of HCFCs, most do not have regulations that control the importation of ACs that use HCFCs. According to JARN, only South Africa has implemented HCFC regulations that cover AC units. ACs with the R-410A refrigerant are popular in African markets. In South Africa, ACs using this refrigerant make up almost 70% of the market, while in other countries they represent between 20% and 50% of units in the market (Figure 8).

Figure 8: Market share of AC refrigerants in four African markets

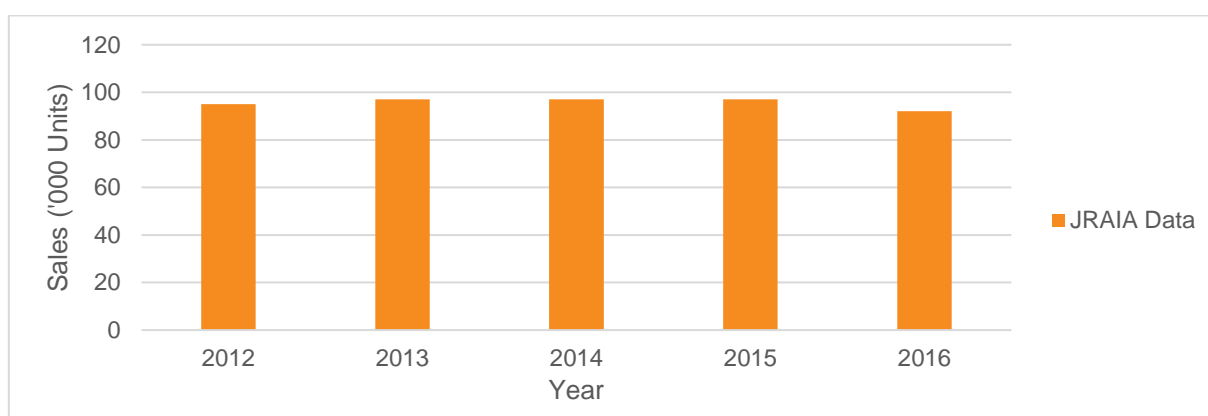


05 National Market Assessment – Ghana

5.1 Market Size

According to the JRAIA report, the market size for ACs in Ghana has remained fairly constant during the past few years. Annual sales of ACs were just below 100,000 units from 2012 to 2016, with a slight decline in sales in 2016 (Figure 9). According to the stakeholders interviewed, the slight decrease might be traceable to the uncertain economic climate caused by the national elections held that year. AC sales might also increase in the coming years due to an increasing middle-class in Ghana with people building larger homes.⁹

Figure 9: Annual AC sales in Ghana



5.2 Market Characteristics

5.2.1 Data Sources

CLASP searched the following online shops¹⁰ available in Ghana to gather product information:

- <https://www.jumia.com.gh/air-conditioning/>
- https://www.zoobashop.com/home-appliances/home-electricals/air-conditioners-fans.html?c2c_actype=849

CLASP gathered product information for 118 models, among which 106 are unique models. Twelve are duplicative models, which are sold in several different online shops. However, as explained in Section 0, duplicates are included in CLASP's analysis.

5.2.2 Major Brands

According to the data gathered from online stores, the following brands dominate the Ghana AC market (Figure 10):

- Chinese brands (38%): NASCO,¹¹ Midea, TCL, Aucma, Chigo
- South Korean brands (33%): Samsung, LG, Daewoo
- Japanese brands (14%): Panasonic and Daikin
- European brands (10%): Bruhm (Germany), Beko (Turkish), Westpoint (French)

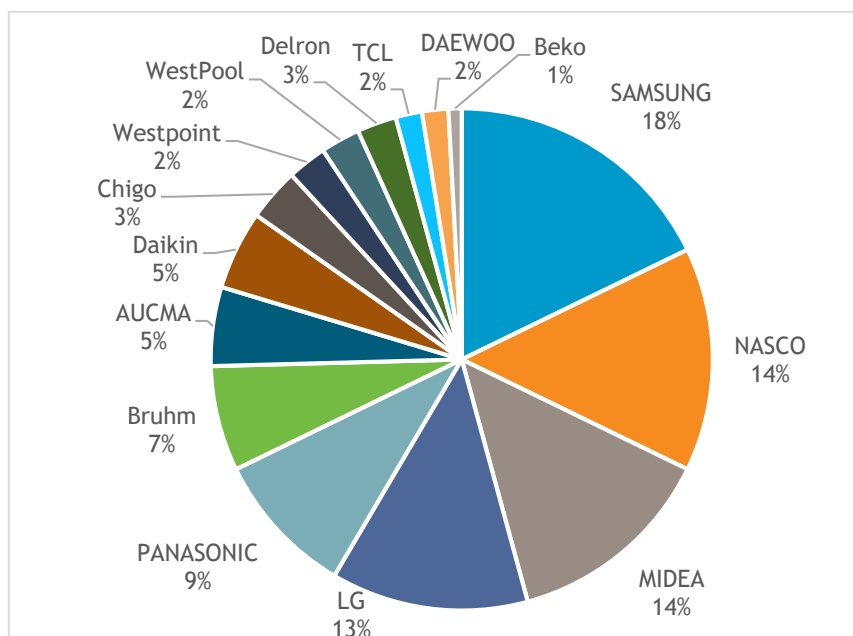
From the stakeholder interviews, other brands present in the market include Sigma (a local brand manufactured in China), Hisense, Galanz, and Haier.

⁹ Interview with representative of the Ghana Environmental Protection Agency

¹⁰ There is not any information available on the share of ACs bought from online stores versus retailers. According to CLASP's interviews with government officials in various countries, online stores and sales are not currently monitored.

¹¹ NASCO is part of Chigo Group – a Chinese appliance manufacturer.

Figure 10: Major AC brands in Ghana (N=118)



5.2.3 AC Types, Functions, Capacities, and Prices

Split ACs account for 97% of all surveyed models, whereas window units only account for a very small market share (Figure 11). This is in line with the report from JRAIA and information gathered from the stakeholder interviews⁹ where split AC accounts for almost the entire AC market in Ghana.

In Ghana, horsepower (HP) was used as a metric for AC sizes. Usually, HP is used to designate input power not cooling capacity. However, the cooling capacity depends on both input power and energy efficiency. Since only HP data was available, CLASP developed a conversion between HP and Btu/hr, assuming a constant EER, using the following equation:

$$\text{EER} = \text{Cooling Capacity (Btu/hr)} / \text{Input Power (HP)}$$

Assuming that the ACs have an EER of 2.8 (W/W),¹² the cooling capacity of a 1.0 HP AC unit can be calculated as follows:

$$\text{CC} = 1.0 \text{ (HP)} \times 746 \text{ (W/HP)} \times 2.8 \text{ (W/W)} = 2089 \text{ W} = \mathbf{7127 \text{ Btu/hr}}$$

The conversion between horsepower and cooling capacity using this formula is shown in Table 2 below. **These calculations are only intended to give readers context about AC sizes using HP. The true cooling capacity can only be derived knowing the input power and the energy efficiency of the AC.** Advertising only the HP in ACs can be misleading as manufacturers and retailers can sell consumers poorly performing ACs by only quoting the HPs.

Table 2: Approximate conversion from horsepower to cooling capacity assuming EER of 2.8 (W/W)

Horsepower	Approximate Cooling Capacity (Btu/hr)
1.0 HP	7100
1.5 HP	10700
2.0 HP	14300
2.5 HP	17800
3.0 HP	21400

¹² This is the Minimum Energy Performance Standard for ACs set by the Ghana Energy Commission

Mid-size ACs with 1.5 HP and 2 HP input power are the most popular in Ghana, followed by 2.5 HP (Figure 12). Collectively, small (1HP) and large units (>3HP) account for less than 15% of the market.

Figure 11: Types of ACs in Ghana (N=118)

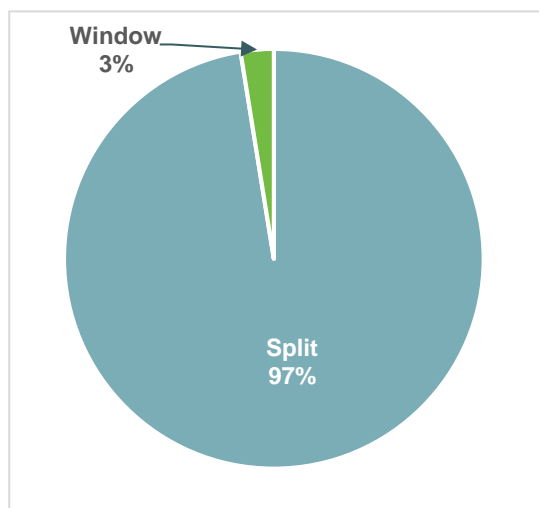
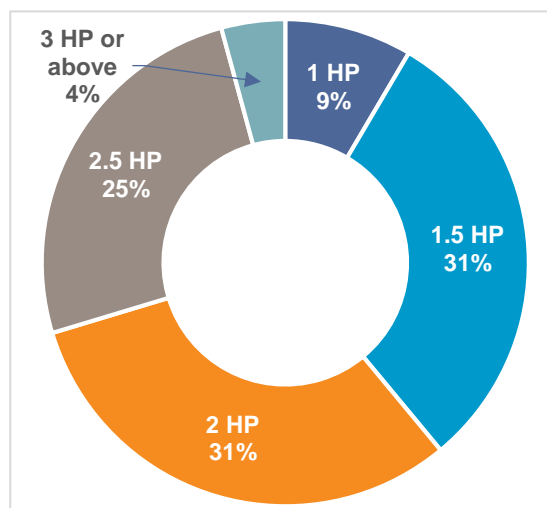
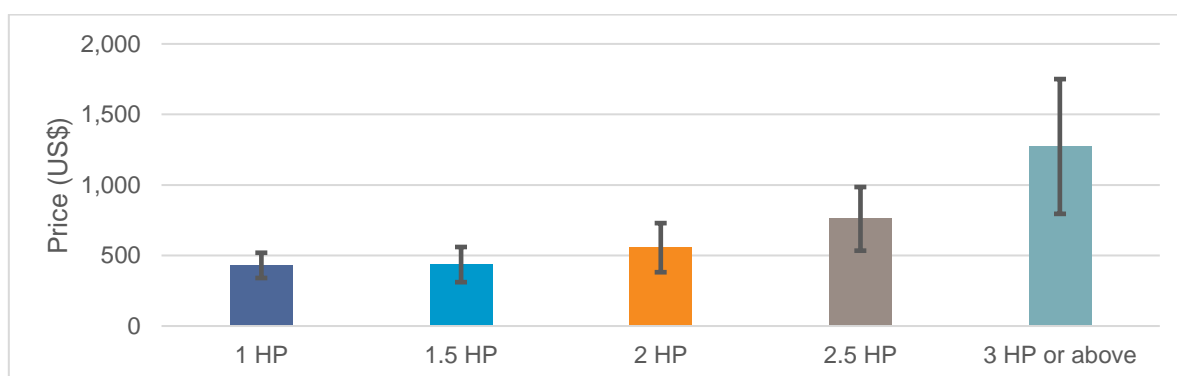


Figure 12: AC sizes in Ghana (N=118)



The average prices of ACs in Ghana range from approximately US\$430 for a 1HP model to US\$760 for a 2.5 HP model. The average price for larger size units (>3 HP) is approximately US\$1,273. AC prices primarily depend on the capacities as shown in Figure 13.

Figure 13: Average prices of different size AC units in Ghana (N=118)



5.2.4 Energy Performance

Online shops in Ghana did not provide energy performance information for ACs. However, from conversations with the Ghana Energy Commission,¹³ consumers are aware of energy efficiency metrics for various appliances. This is mainly because of the extensive consumer awareness campaigns carried out after the introduction of mandatory standards and labelling for appliances, including ACs, in 2005. Currently, the commission does not monitor online shops, which would explain the lack of energy performance information on these websites.

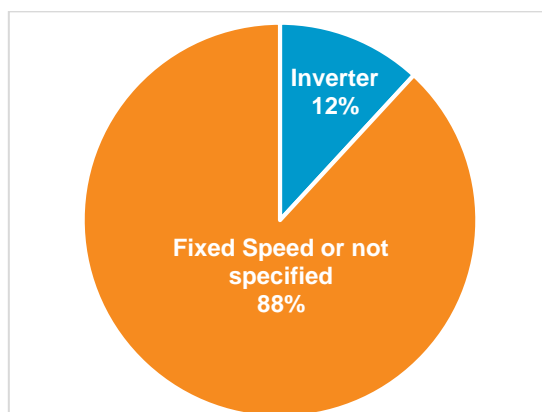
5.2.5 Availability of Inverter Technologies and Refrigerant Types

Inverter technologies are available on the market but with a very limited market presence (Figure 14). This might be due to the higher cost associated with inverter ACs and a lack of consumer awareness on the advantages of inverter technology. Inverter ACs are available from major brands such as Samsung, NASCO, Midea, LG, Panasonic, and Daikin. Although Ghana has a successful appliance S&L program, its

¹³ Interview with the Director of Energy Efficiency & Climate Change at the Ghana Energy Commission.

current AC standards only cover fixed speed ACs. These standards have however been revised to take into account inverter ACs.¹⁴ This could lead to an increase in the share of inverter ACs in the market.

Figure 14: Types of AC compressors in Ghana (N=118)



Product data on refrigerants was also not available in the online shops. R-22 refrigerant is still in use in some ACs but R-410A is becoming more common. The Ghana Energy Commission collects refrigerant data for all imported ACs.¹³

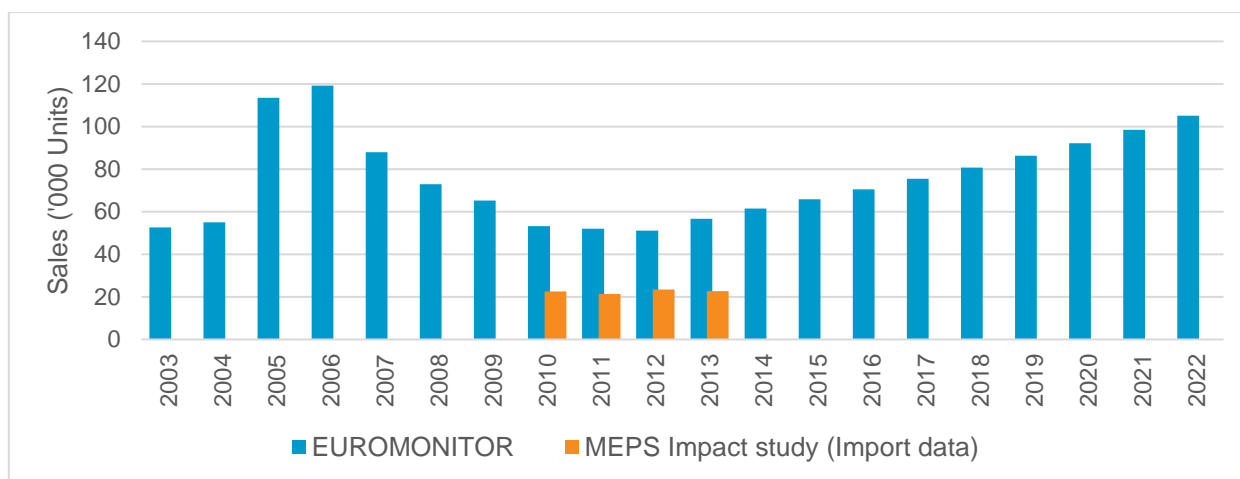
¹⁴ The AC standards were reviewed in October 2017, but until the regulations backing the standards are reviewed and passed by parliament of Ghana, they remain voluntary, i.e. they cannot be enforced by law.

06 National Market Assessment – Kenya

6.1 Market Size

The market size for ACs in Kenya, according to Euromonitor and a 2014 market study,¹⁵ was anywhere between 20,000 to 80,000 units per year in the last five years (Figure 15). Euromonitor, using modelled data, estimates that annual market growth for ACs will be approximately 7% from 2016 to 2022.

Figure 15: Annual AC sales/ imports in Kenya



6.2 Market Characteristics

6.2.1 Data Sources

CLASP sourced the AC product information used in this study from the following 14 online shops in Kenya:

- <http://shopit.co.ke/>
- <http://armcokenya.com/>
- <http://alfremo.com/>
- <http://housewifesparadise.com/>
- <http://avechi.co.ke/>
- <https://hotpoint.co.ke/>
- <https://www.zedsons.com/>
- <http://www.jumia.co.ke/>
- <http://www.shop.snowdesert.co.ke>
- <http://lg.brandshop.co.ke/>
- <https://www.masoko.com/>
- <http://almansoor.co.ke>
- <http://www.shankarelectronics.co.ke/>
- <http://bidorbuy.co.ke>

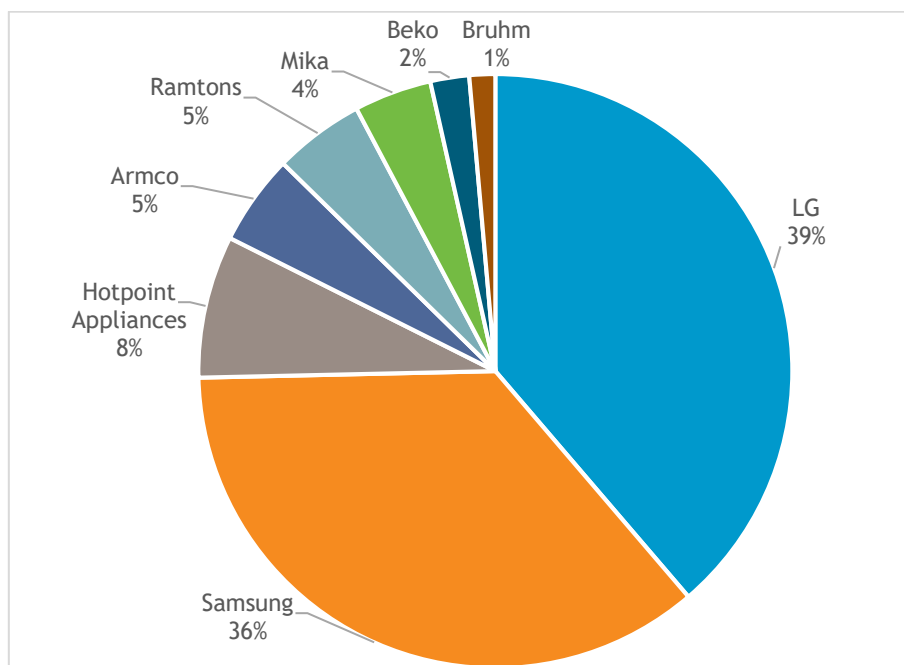
CLASP gathered product information for 142 AC products, out of which 88 are unique products. Fifty-four are duplicative models, which are sold in several different online shops. However, as explained in Section 0, duplicates are included in CLASP's analysis.

6.2.2 Major Brands

Local brands that purchase components from Chinese manufactures like Hotpoint, Armco, Ramtons, Mika and Bruhm collectively hold a significant market share (33%). However, South Korean brands, Samsung and LG dominate the Kenyan AC market with almost equal individual market shares and a combined market share of 75%. One Turkish brand, Beko, has a 2% market share (Figure 16).

¹⁵ U.N. Development Program (UNDP). *Impacts of Energy Performance Standards and Labels Implementation in Kenya*. 2014.

Figure 16: Major AC brands in Kenya (N=142)

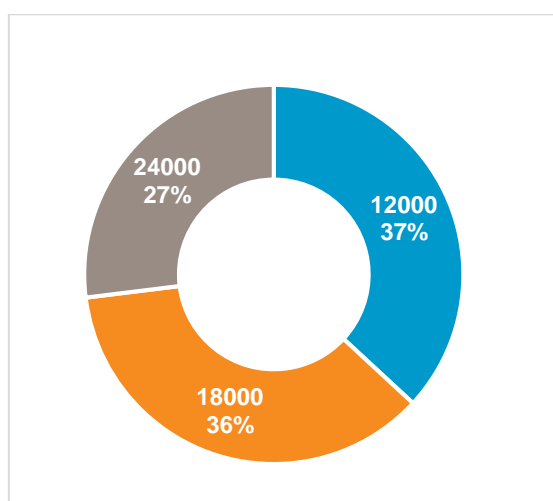


6.2.3 Capacities, Types, Functions, and Prices

Out of the 142 AC models, all are split AC units and none are window AC units.

The Kenyan AC market includes three main cooling capacities, 12,000 Btu/hr, 18,000 Btu/hr, and 24,000 Btu/hr. The 12,000 Btu/hr and 18,000 Btu/hr have an almost equal market share of 37% and 36% respectively (Figure 17). The absence of lower capacity ACs, for example 9,000 Btu/hr, could be because ACs are rarely used in residential applications in Kenya, and are more commonly used in commercial applications like hotels, banking halls, and offices, among others.¹⁶

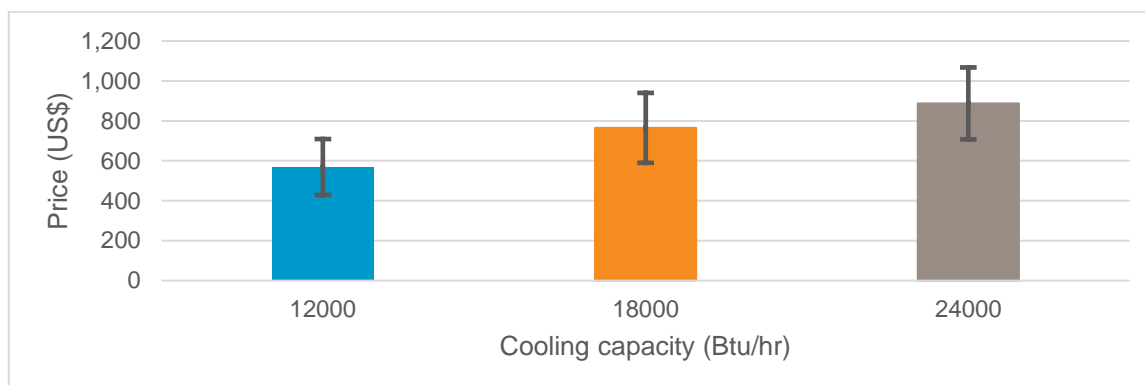
Figure 17: AC cooling capacities in Kenya (N=142)



The average prices by capacity are US\$ 569 for 12,000 Btu/hr units, US\$ 765 for 18,000 Btu/hr units and US\$ 888 for 24,000 Btu/hr units (Figure 18).

¹⁶ Interview with IGSD recommended expert in Kenya

Figure 18: Average prices of different capacity AC units in Kenya (N=142)



6.2.4 Energy Performance

The EER was only provided for 24 products. The input power, which was used to calculate the EER, was provided for an additional five products. Where possible, CLASP estimated EERs using the following equation:

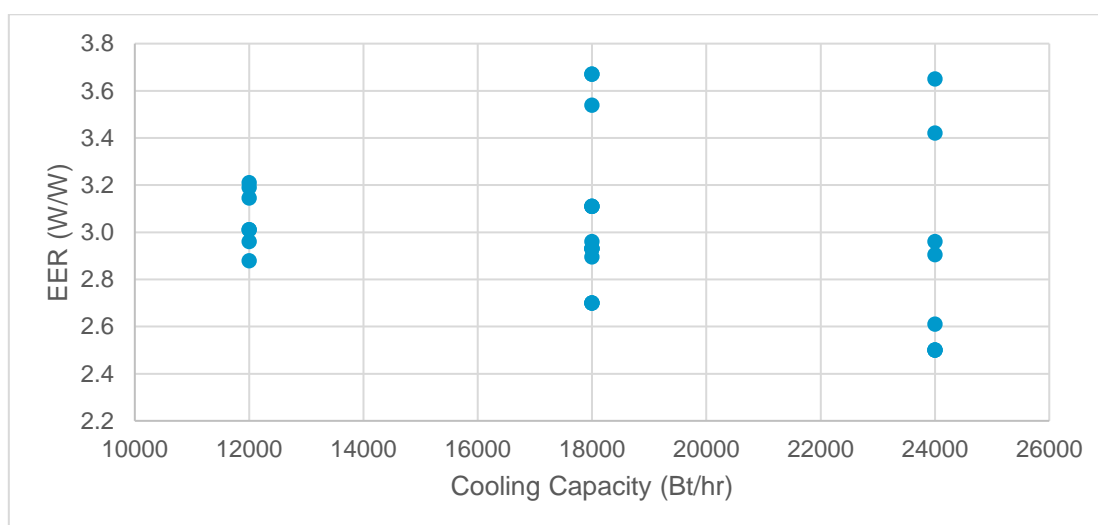
$$\text{EER (W/W)} = \text{Cooling Capacity in W} / \text{Power input in W}$$

There are some obvious limitations to this approach of estimating EER. However, in the absence of comprehensive data, this first order estimate on AC energy performance can still be helpful for policymakers.

Using the data from these 29 products, the relationship between EER and cooling capacity shows that the AC products with a 24,000 Btu/hr cooling capacity have the lowest EERs (i.e., as low as 2.5 W/W). However, there are a few products with EERs above 3.4 W/W available in the market (Figure 19).

Kenya has MEPS for ductless ACs that came into force in 2016 and are applicable to ACs manufactured or imported after July 2017 and those retailed after July 2018.¹⁷ The minimum EER under regulatory standard KS 2463:2013 is 2.8 W/W. Under this requirement, at least three products in this study must be phased out of the market by July 2018 (Figure 19).

Figure 19: The energy performance of ACs in Kenya (N=29)



¹⁷ The Energy (Appliances' Energy Performance and Labelling) Regulations, 2016

6.2.5 Availability of Inverter Technologies and Refrigerant Types

Although, the manufacturers of the main AC products in the Kenyan market, Samsung and LG, sell ACs with inverter compressors in other markets, inverter ACs command a low market share in Kenya (Figure 20). Similar to other countries in this report, the low penetration of these more efficient AC types might be due to low consumer awareness of energy efficiency, and by extension inverter compressors, and cost.

The type of refrigerant used in the AC products appears not to be an important product parameter to Kenyan AC customers since this was not listed in 51% of the products surveyed (Figure 21). Additionally, five out of the eight identified AC brands had products using R-22 refrigerant on the market. Although importation of HCFCs is controlled through quotas,¹⁸ importation or sale of appliances containing HCFCs like R-22 is not controlled. Regulations are currently being reviewed to capture these appliances and facilitate the phase down of HCFC use in Kenya.¹⁶

Figure 20: Types of AC compressors in Kenya (N=142)

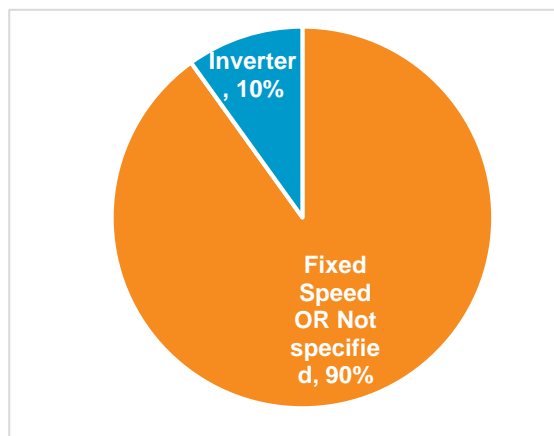
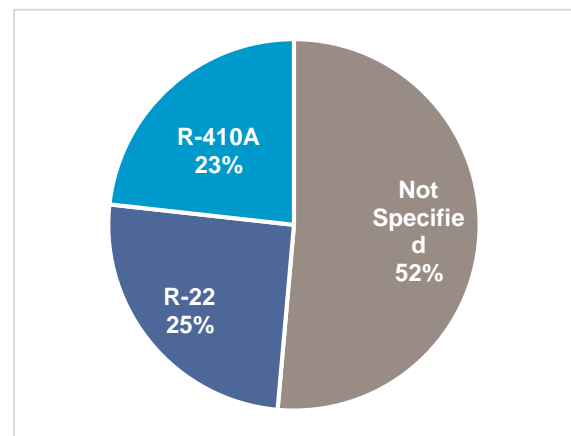


Figure 21: Types of AC refrigerants in Kenya (N=142)



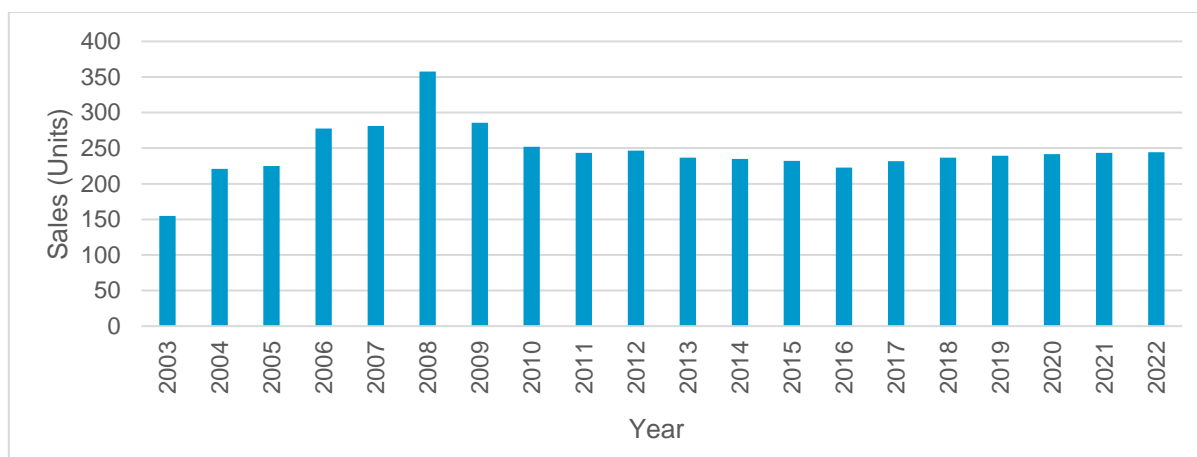
¹⁸ Environmental Management and Co-ordination (Controlled Substances) Regulations, 2007

07 National Market Assessment – Mauritius

7.1 Market Size

According to Euromonitor data, the AC market in Mauritius is only about 200 units per year with an annual projected growth rate of 5.3% from 2017 to 2022. However, given the product variety found online, this does not seem realistic. Unfortunately, CLASP could not corroborate the sales figures through interviews.

Figure 22: Annual AC sales in Mauritius



7.2 Market Characteristics

7.2.1 Data Sources

CLASP obtained the AC product information used in this study from the following 12 online shops in Mauritius:

- <https://361.mu/>
- <https://buynow.mu/>
- <https://www.galaxy.mu/>
- <https://www.jkalachand.com/>
- <https://www.lacase.mu/en/>
- <https://priceguru.mu/>
- <https://www.mycart.mu>
- <https://savegenie.mu>
- <https://ibuy.mu>
- <https://issuu.com>
- <https://zanana.mu>
- <http://www.kingbros.mu>

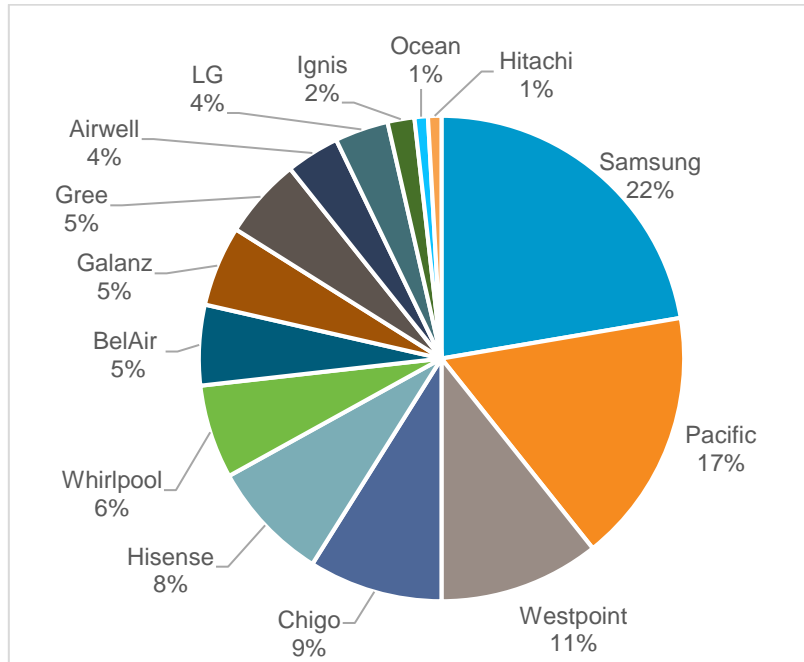
CLASP found 112 products in online shops, of which 71 are unique models. Forty-one are duplicative models, which are sold in several different online shops. However, as explained in Section 0, duplicates are included in CLASP's analysis.

7.2.2 Major Brands

The Mauritian AC market has a fair amount of brand variety; there are at least 14 different brands in the market (Figure 23):

- Chinese brands (49%): Pacific, Chigo, Hisense, BelAir, Galanz, Gree
- South Korean brands (26%): Samsung and LG
- European brands (16%): Westpoint (France), Airwell (France) and Ocean (Italy)
- USA brands: Whirlpool and Ignis (also a Whirlpool brand)

Figure 23: Major AC brands in Mauritius (N=112)



7.2.3 AC Types, Functions, Capacities, and Prices

All 112 AC models in online shops are split AC units and none are window AC units. This is in line with Euromonitor data that shows that all units sold in Mauritius are split ACs.

Cooling and heating ACs are significantly more popular in the market than cooling-only products; 44% of products in online shops listed AC functions, cooling-only or heating and cooling, indicating this is an important feature for AC customers (Figure 24).

In terms of cooling capacity, the most common AC product is the 12,000 Btu/hr unit with a 37% market share. There are a few 9,000 Btu/hr units available in the market (Figure 25).

Figure 24: AC functions in Mauritius (N=12)

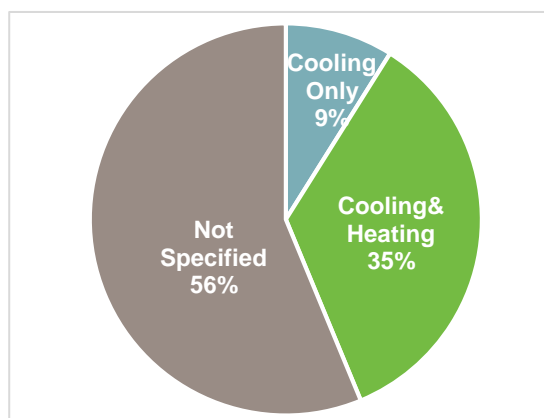
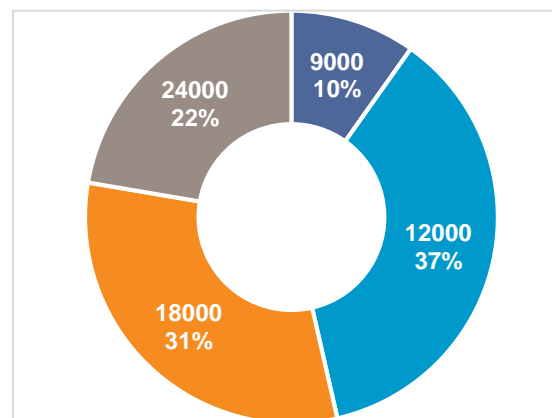
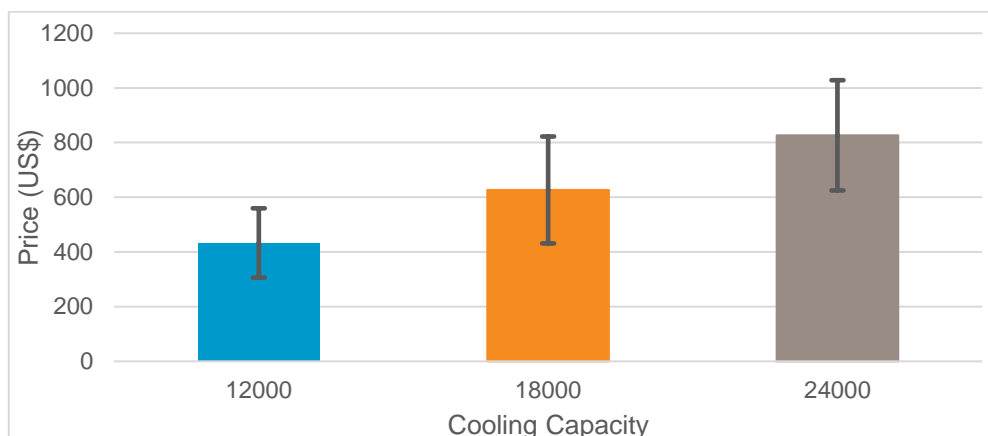


Figure 25: AC cooling capacities in Mauritius (N=112)



The average prices for the different capacities in Mauritius are US\$ 445 for 12,000 Btu/hr units, US\$ 606 for 18,000 Btu/hr units and US\$ 804 for 24,000 Btu/hr units.

Figure 26: Average prices of different capacity AC units in Mauritius (N=112)



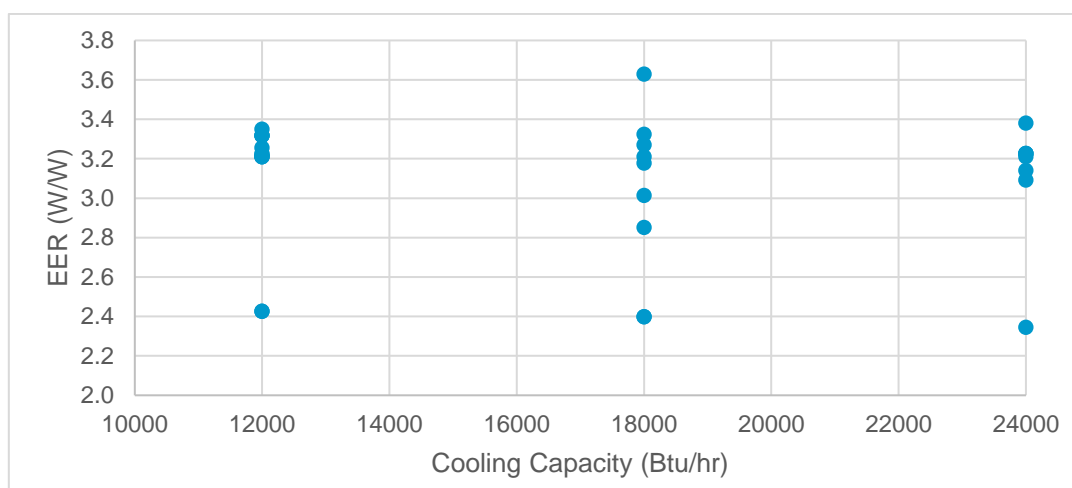
7.2.4 Energy Performance

The EER was only provided for seven products out of the 112 products listed in the online shops. To expand the data set, the approximate EER for an additional 22 units was calculated using the input power data and the cooling capacity in accordance with the method outlined in section 6.2.4.

Using the data from these 29 products, the relationship between EER and cooling capacity shows that the AC products of all three dominant capacities have EERs in the lower range (~2.4 W/W) and in the higher range (~3.4 W/W).

The current S&L regulations passed in 2017 only cover dishwashers, ovens and refrigerators.¹⁹ However, according to the Energy Efficiency Management Office, Mauritius may put in place an S&L program for ACs in 2019.²⁰ Additionally, from 2014, inefficient ACs (those below class D rating (2.6 W/W) of the now repealed EU Directive 2010/30/EU²¹) attract a 25% customs excise duty.²²

Figure 27: Energy performance of ACs in Mauritius (N=29)



¹⁹ Energy Efficiency Management Office (EEMO). *Energy Efficiency (Labelling of Regulated Machinery) Regulations 2017*. (GN 11 of 2017). http://eemo.govmu.org/English/Documents/Reg_Label_0117.pdf

²⁰ EEMO. *Energy Efficiency (Labelling of Regulated Machinery) Regulations 2017*. http://eemo.govmu.org/English/Documents/Energy_Labelling.pdf

²¹ Elahee M.K, "Energy Management and Air-Conditioning in Buildings in Mauritius: Towards Achieving Sustainability in a Small-Island Developing Economy Vulnerable to Climate Change," *Energy Procedia*, 62, (2014), <https://doi.org/10.1016/j.egypro.2014.12.426>

²² Ministry of Finance. *Budget Speech 2014: Building a Better Mauritius; Creating the Next Wave of Prosperity*. <http://mof.govmu.org/English/Documents/Budget2014/BudgetSpeech2014.pdf>

7.2.5 Availability of Inverter Technologies and Refrigerant Types

Similar to other countries in this study, the penetration of inverter ACs is low in Mauritius (Figure 28). The type of refrigerant used in AC units seems to be an important feature for customers since refrigerant type was listed in 46% of the products found on the online shops. For products that disclosed refrigerant type, all the ACs used the R-410A refrigerant (Figure 29).

Figure 28: Types of AC compressors in Mauritius (N=112)

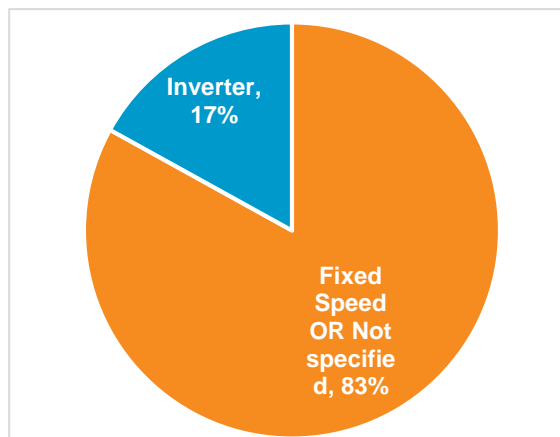
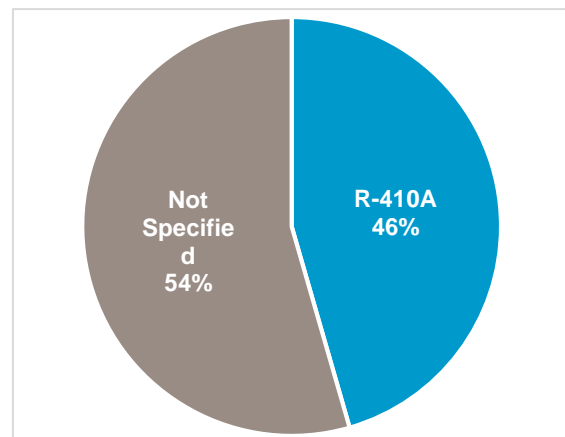


Figure 29: Types of AC refrigerants in Mauritius (N=112)



08 National Market Assessment – Nigeria

8.1 Market Size

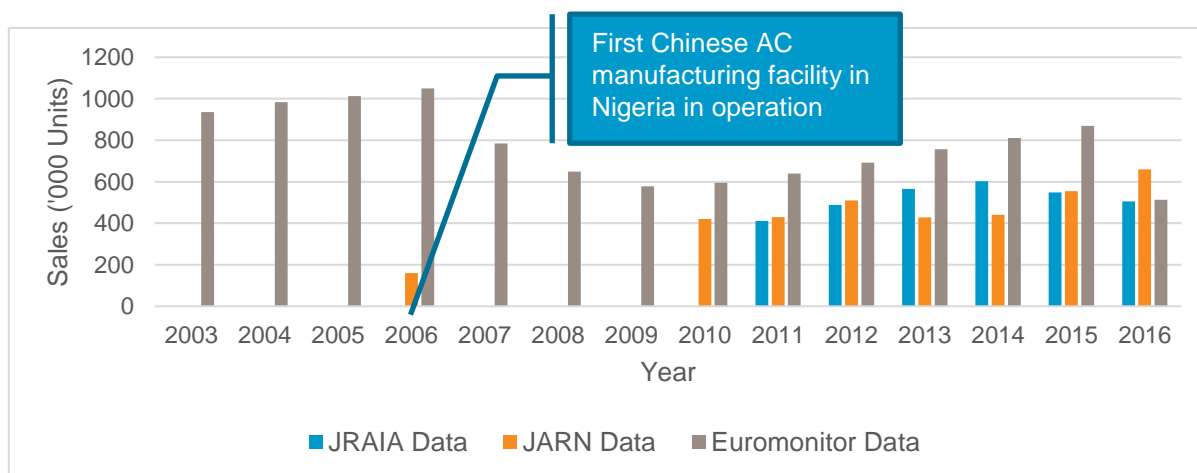
CLASP relied on three data sources to determine the size of the Nigerian AC market: Euromonitor, JARN, and JRAIA. These three data sets are plotted in Figure 30.

Compared to JARN and JRAIA data, Euromonitor data for Nigeria has been consistently higher. In 2006, Euromonitor reported sale of over 1 million AC units whereas JARN reported merely 160,000 units. Given that the first Chinese AC manufacturer's facility opened in Nigeria in 2006, marking the beginning of local AC manufacturing in Nigeria, CLASP considers JARN data more realistic. From year 2010 to 2016, JARN and JRAIA data are similar. Approximately 500,000 to 660,000 ACs were sold in Nigeria in 2016.

The key port of entry for imported ACs in Nigeria is Lagos Port, though Port Harcourt is also active. However, some products are illegally smuggled into Nigeria across the northern borders and the border with the Republic of Benin.

Chinese electronics and AC manufacturer Shinco set up a factory in Nigeria that began operations in 2006. This was the first project that a Chinese home appliance company completed in Africa. The success of the factory provided a new way for Chinese home appliance players to develop their sales in the African market, including Haier Thermocool. Further, Japanese brands such as Panasonic also started setting up assembly plants in Nigeria in 2016. With continued investment from overseas, the local AC manufacturing base in Nigeria will likely expand to meet growing AC demand in Nigeria and the rest of Africa.

Figure 30: Annual AC sales in Nigeria



8.2 Market Characteristics

8.2.1 Data Sources

Online shopping for ACs appears to be more popular in Nigeria in comparison to other African countries. There are several major websites that offer a wide range of AC products. For example, konga.com offers more than 600 AC products on its website, whereas Jumia.com offers over 300 models. Given the large number of products available on each website and available time and resources to gather this data, CLASP only collected data from Jumia.com. In total, 334 models were extracted from the website:

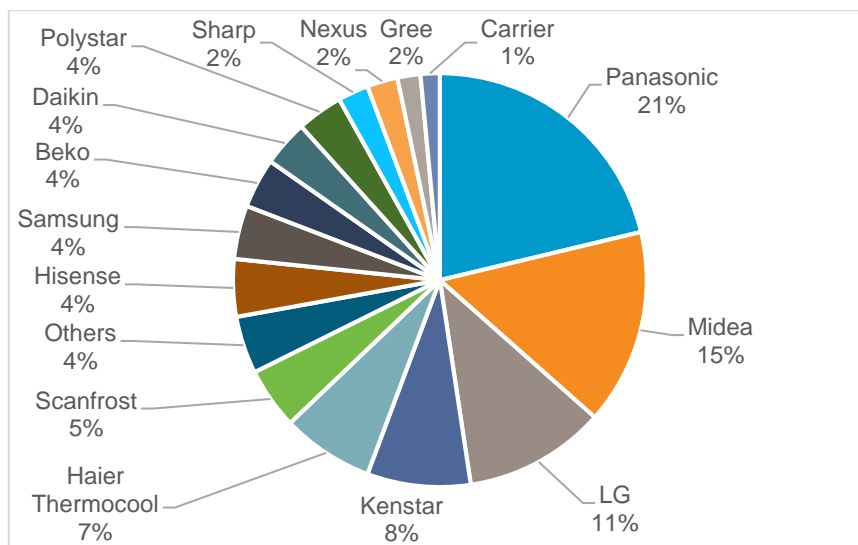
- <https://www.jumia.com.ng/air-conditioning/>

8.2.2 Major Brands

Chinese, Japanese, and Korean brands are the most popular in Nigeria, accounting for over 70% of all models surveyed in this study (Figure 31). Panasonic is the most popular brand, followed by Midea and LG. Indian brand Kenstar also takes a significant market share in fourth place. Scanfrost, a local Nigerian brand, has a fair presence on the AC market. Major AC brands in Nigeria are as follows:

- Chinese brands (28%): Midea, Haier, Hisense, and Gree
- Japanese brands (27%): Panasonic, Daikin and Sharp
- South Korean brands (15%): LG and Samsung
- India brand: Kenstar
- Nigerian brands: Scanfrost

Figure 31: Major AC brands in Nigeria (N=334)



8.2.3 AC Types, Functions, Capacities, and Prices

Split ACs account for 89% of all surveyed models, whereas window units only account for a very small market share (Figure 32). This is in line with the report from JRAIA, where split ACs account for almost the entire AC market in Nigeria.

Similar to Ghana, horsepower (HP) was the major metric used for AC sizes. Small to mid-sized ACs with 1 HP and 1.5 HP input power are the most popular models in Nigeria, whereas 2.5 HP models also take a significant market share. Large units (>3HP) only account for a very small market share (Figure 33).

Figure 32: Type of ACs in Nigeria (N=334)

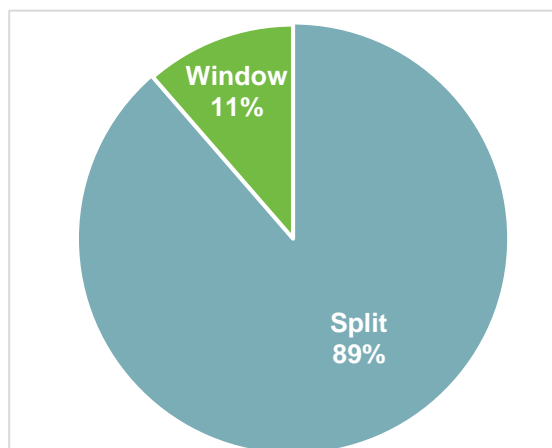
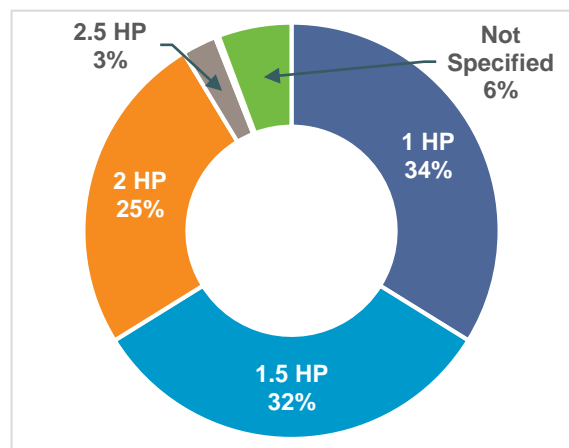
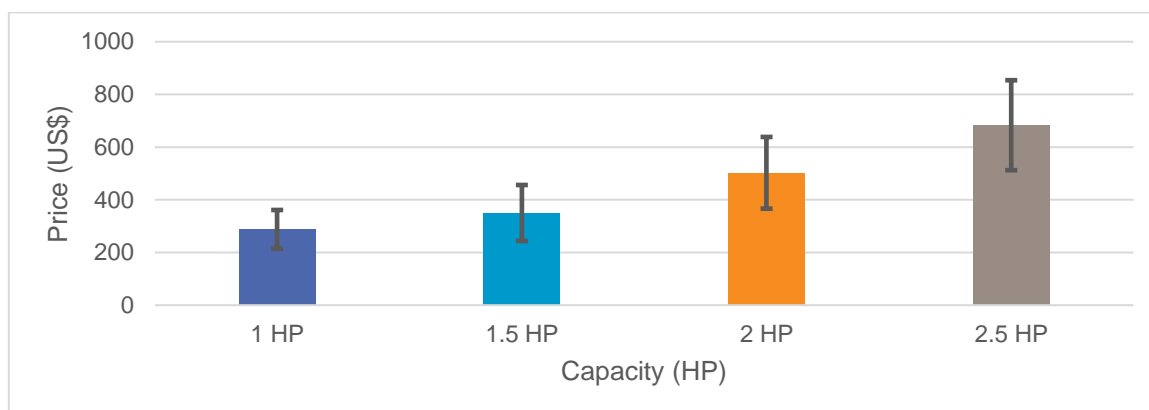


Figure 33: AC sizes in Nigeria (N=334)



The average prices of ACs in Nigeria are approximately US\$288 for a 1HP model to US\$683 for a 2.5 HP model. The average price of ACs is approximately US\$377. AC prices primarily depend on capacities (Figure 34).

Figure 34: Average prices of different size AC units in Nigeria (N=334)



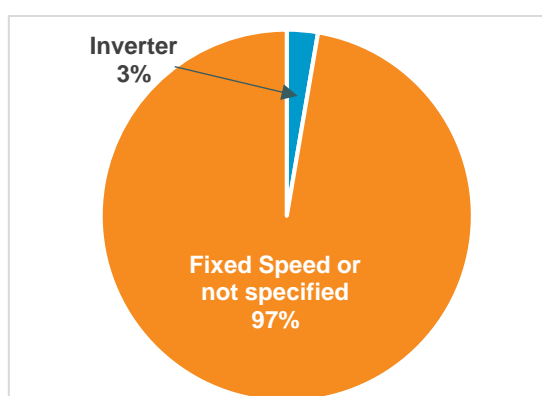
8.2.4 Energy Performance

The online shop rarely provided energy performance information for ACs. The Standard Organization of Nigeria (SON) launched a standard and labeling program in 2017 that includes MEPS for ACs.²³ However, the details of the MEPS that were officially adopted are not readily available. The proposed MEPS was 2.8 W/W.²⁴ Enforcement of the label will start in early 2019,²⁵ which might explain why the label was not observed on any of the products available in the online shop.

8.2.5 Availability of Inverter Technologies and Refrigerant Types

Inverter technologies are available on the market but with very limited market presence (Figure 35). The price differential and consumer awareness of inverter technology and energy efficiency, could explain the lack of market presence of inverter ACs.

Figure 35: Types of AC compressors in Nigeria (N=334)



No refrigerant data was available in the online stores. The Nigeria HFC Inventory reports that R-410A is the most popular HFC blend and is increasingly being used to replace R-22 in AC units.²⁶

²³ Standards Organization of Nigeria (SON). "SON introduces national energy efficiency label for air-conditioners, electrical appliances and equipment." July 2017. <http://son.gov.ng/son-introduces-national-energy-efficiency-label-for-air-conditioners-electrical-appliances-and-equipment/>

²⁴ Stakeholder interview with local expert

²⁵ SON. "Nigeria launches energy efficiency label." August 2017. <http://son.gov.ng/nigeria-launches-energy-efficiency-label>

²⁶ David Bola Omotosho. *HFC Inventory Nigeria 2008-2014*. UNDP (2015).

09 National Market Assessment – South Africa

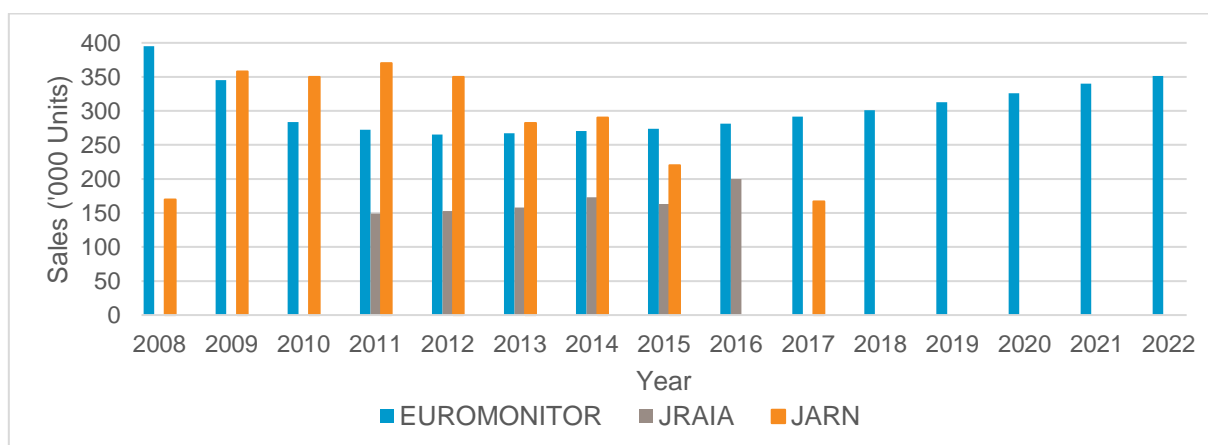
9.1 Market Size

South Africa is the third largest AC market in Africa, after Nigeria and Egypt. According to data gathered by Euromonitor, JRAIA and JARN, AC sales in the South African market in 2017 were between 160,000 and 280,000 units (Figure 36). Some of these units may be ACs imported through South Africa and then re-exported to surrounding Southern African countries. This might explain the differences in market sizes between the different sources, with some perhaps relying on import data to size the market, hence the higher figures.

According to JARN, the slow economic growth in South Africa in recent years has affected AC sales. However, Euromonitor estimates an annual market growth rate of approximately 5 to 6% from 2018 – 2022.

Some AC brands manufacture or assemble AC units locally. For example, AIAC Air Conditioning²⁷ manufactures larger capacity AC units like cassette ACs, while WP manufacturing²⁸ manufactures console ACs. According to their website, Chigo, a Chinese brand, also has local AC production and assembly plants.²⁹ In 2013, Hisense set up an appliance assembly plant in South Africa that manufactures televisions and refrigerator, but so far there are no reported plans to start manufacturing ACs in country.^{30, 31}

Figure 36: Annual AC sales in South Africa



9.2 Market Characteristics

9.2.1 Data Sources

CLASP searched several online shops in South Africa that include ACs to source product and price data. For this study, CLASP also used company websites like LG, Hisense, and Alliance to gather information on models available in the South African market. CLASP used the following websites to collect AC product data:

- www.pricecheck.co.za
- www.hisense.co.za
- www.lgairconditioning.co.za
- www.gettingadeal.co.za
- www.findyourdeal.co.za
- www.aircare.co.za
- <https://www.takealot.com>
- <http://www.saairconditioning.co.za>

²⁷ Airedale. "Africa Air Conditioning." 2018. <http://www.airedale.com/web/About-Airedale/Global-Partners/Africa.htm>

²⁸ Westair. "About – Westair Air Conditioning." 2018. <http://westair.co.za/about/>

²⁹ Chigo. "About | Chigo Air – Conditioning." 2018. <https://www.chigo.co.za/about#companyProfile>

³⁰ Hisense. "About Hisense South Africa." 2018. <http://www.hisense.co.za/about-hisense>

³¹ Defy/Arcelik has their own AC brand and locally manufactures other appliances - gas ovens, washing machines, dryers and ovens - but not ACs.

- <https://www.metrohomecity.co.za>
- <https://aircononline.co.za>
- <http://cheapaircon.co.za>
- <https://www.builders.co.za>
- <http://www.airconexperts.co.za>
- <http://aircon.mideasouthafrica.com>
- <http://www.dionwired.co.za>
- <https://www.allianceair.co.za>
- <http://www.samsung.com/za>

CLASP gathered product information for 236 products found in online shops, of which 192 are unique products. Forty-four are duplicative models, which are sold in several different online shops. However, as explained in Section 0, duplicates are included in CLASP's analysis.

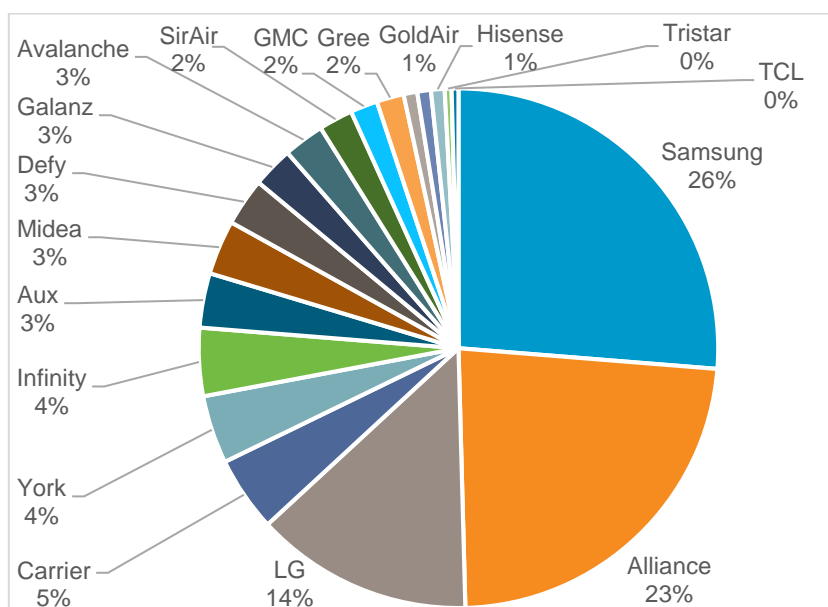
9.2.2 Major Brands

There is a fair amount of brand variety in the South African AC market, with at least 19 brands. The estimated market share for each brand is shown below (Figure 37).

The major brands found in the South Africa market include:

- South Korean brands (40%): Samsung and LG which make up 40% of the market
- South African brands (31%): Alliance³² (has a strong market presence), Defy, GMC, JetAir and SirAir
- Chinese brands (19%): Infinity, Aux, Midea, Galanz, Avalanche, Hisense, Gree, and TCL
- USA brands: York, Carrier
- European brand: Tristar

Figure 37: Major AC brands in South Africa (N=236)



9.2.3 AC Types, Functions, Capacities, and Prices

All of the AC products CLASP came across during this study are split units, which is in line with JARN's findings that split units and portable ACs are the most common AC types in this market.

According to CLASP's research, ACs with both cooling and heating functions are the most popular in the South African market (Figure 38).

³² Fourways Airconditioning / Alliance. "Our Brands." 2018. <https://www.allianceair.co.za/aircon-brands.html>

ACs with the 9,000, 18,000 and 24,000 Btu/hr capacities have an almost equal share in the market (Figure 39). ACs larger than 24,000 Btu/hr, for example 32,000 Btu/hr units, also have a presence in the market. These larger ACs might be in use in offices without centralized AC systems.

Figure 38: AC functions in South Africa (N=236)

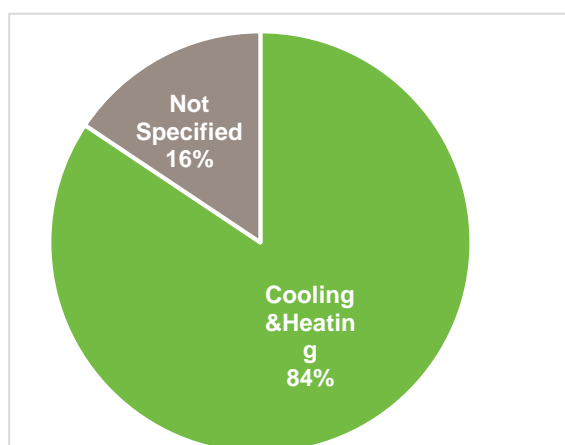
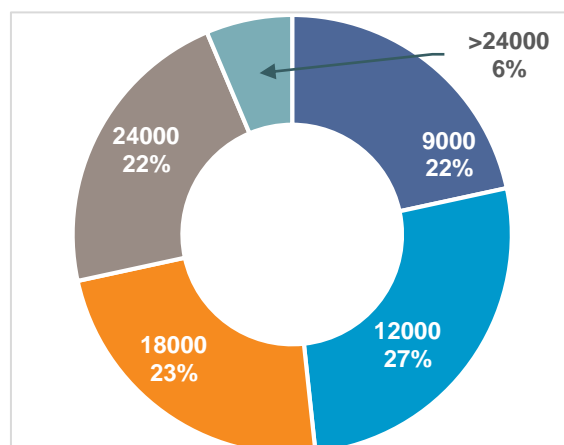
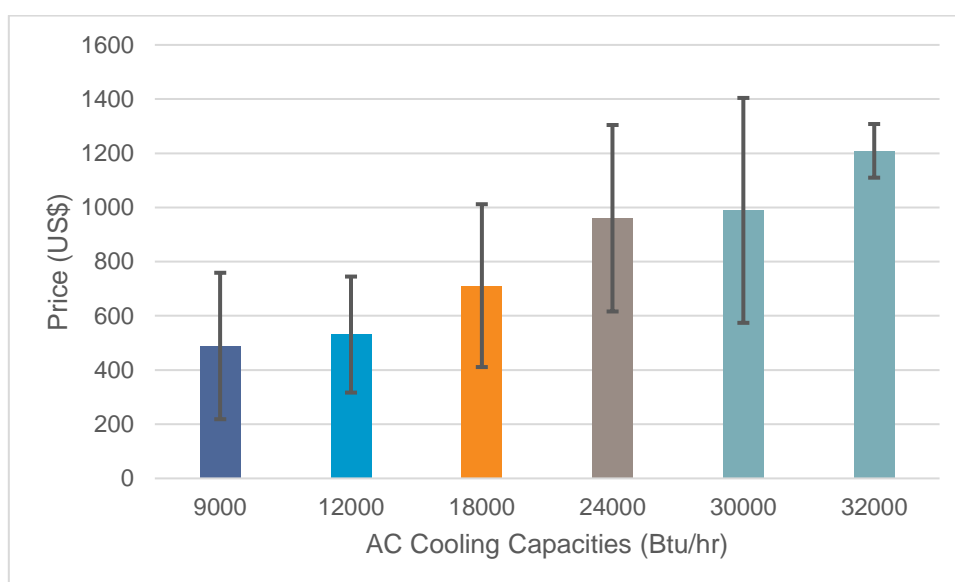


Figure 39: AC cooling capacities in South Africa (N=236)



Similar to other markets in this study, the average prices of ACs correspond with the sizes, with larger capacity ACs having a higher price (Figure 40).

Figure 40: Average prices of capacity AC units in South Africa (N=236)

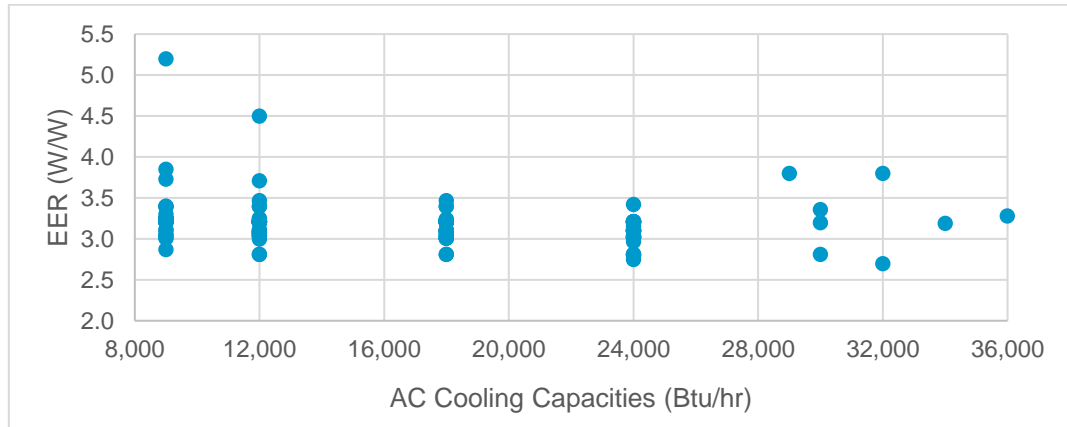


9.2.4 Energy Performance

The EER was provided for 56% of the products listed online. Even when the figure was not listed in the product description, a product brochure with technical specifications was included. This could indicate that consumers consider this metric when purchasing ACs. Additionally, in 2016, South Africa began enforcing its MEPS for ACs and other appliances. These MEPS are applicable only to AC units of less than 24,000

Btu/hr. The South African MEPS are based on EU standards³³ and require a minimum EER of Class B.³⁴ Under the now repealed Directive 2010/30/EU, this is a MEPS of 3.0 W/W. The South African MEPS are currently under review. South Africa is the only African market where AC units with EERs of more than 4.0 W/W were reported (Figure 41) which might be due to the relatively high penetration of inverter ACs (Figure 42).

Figure 41: AC energy performance in South Africa (N=146)



9.2.5 Availability of Inverter Technologies and Refrigerant Types

Unlike other African countries in this study, the South African AC Market has a higher penetration of inverter ACs. This might be the result of consumer education by the South African Department of Energy, which advocates for purchasing inverter ACs as a means of reducing energy consumption.³⁵ JARN estimates that penetration of inverter ACs may be as high as 60% in this market.³⁶

Beginning 2015, South Africa banned importing ACs charged with R-22 or any other HCFC. Consequently, all the AC products that listed refrigerant type use the R-410A refrigerant while the rest did not provide refrigerant information (Figure 43).

Figure 42: Types of AC compressors in South Africa (N=236)

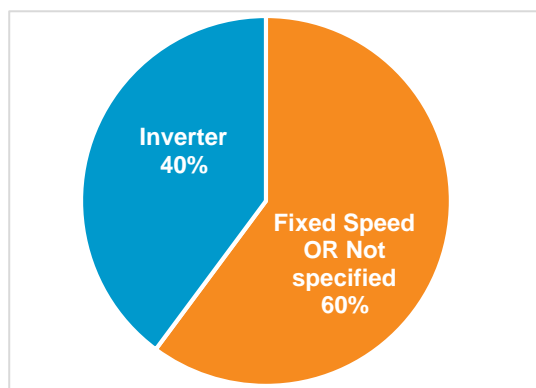
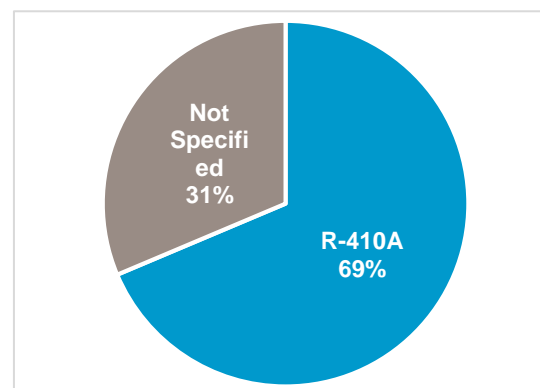


Figure 43: Types of AC refrigerants in South Africa (N=236)



³³ Willa Breed. "Energy efficiency of electrical and electronic apparatus: What does SANS 941 require?" South Africa Bureau of Standards (SABS). May 2012. https://www.engerati.com/sites/default/files/Willa_Breed.pdf

³⁴ Republic of South Africa Department of Energy. "Frequently Asked Questions: Appliance Efficiency." 2018. <https://www.savingenergy.org.za/asl/faqs/>

³⁵ Republic of South Africa Department of Energy. "Air Conditioners." 2018. <https://www.savingenergy.org.za/asl/consumers/air-conditioners/>

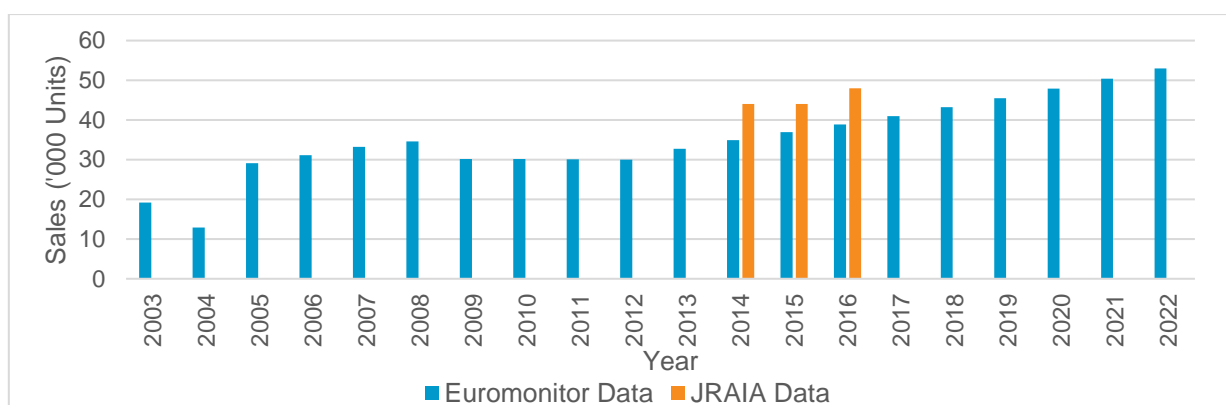
³⁶ <https://www.ejarn.com/news.aspx?ID=49206>

10 National Market Assessment – Tunisia

10.1 Market Size

Based on Euromonitor and JRAIA data, annual AC sales in Tunisia were somewhere between 39,000 units and 48,000 units in 2016 (Figure 44). The overall market size for ACs in Tunisia will likely increase in the next five years. The trend of increasing AC sales can be observed in both Euromonitor and JRAIA data. Euromonitor estimates an approximate 5% increase in sales per annum over the next five years.

Figure 44: Annual AC sales in Tunisia



10.2 Market Characteristics

10.2.1 Data Sources

CLASP searched the following online shops in Tunisia to gather product information:

- <https://www.jumia.com.tn/climatiseurs/>
- <http://www.tunisianet.com.tn/457-climatiseur-tunisie-chaud-froid>
- <http://www.affariyet.com/48-climatiseurs#/>
- <http://www.promouv.com/gros-electro-en-ligne-tunisie/chaud-froid/climatiseur-chaud-froid.html>
- <http://www.mytek.tn/463-climatiseur-tunisie>
- <http://www.mega.tn/electromenager/climatisations/climatiseurs>

CLASP gathered product information for 120 models, of which 72 are unique models. Forty-eight are duplicative models, which are sold in several different online shops. However, as explained in Section 0, duplicates are included in CLASP's analysis.

10.2.2 Major Brands

The following foreign brands dominate the Tunisian AC market:

- Chinese brands (34%): Haier, TCL, and Midea
- South Korean brands (27%): Samsung and LG
- European brands (19%): Beko (Turkish) and Westpoint (French)

Local players are very small (8%) in comparison to other major brands. Three local brands were identified: Coala,³⁷ Servicom,³⁸ and Condor.³⁹ However, CLASP was not able to verify whether products under these three brands are assembled in Tunisia, where there is some local AC assembly.⁴⁰

Additionally, the Falcon brand has a significant market presence but CLASP was not able to identify the

³⁷ Coala-Tunisie. 2018. <http://www.coala-tunisie.com/>

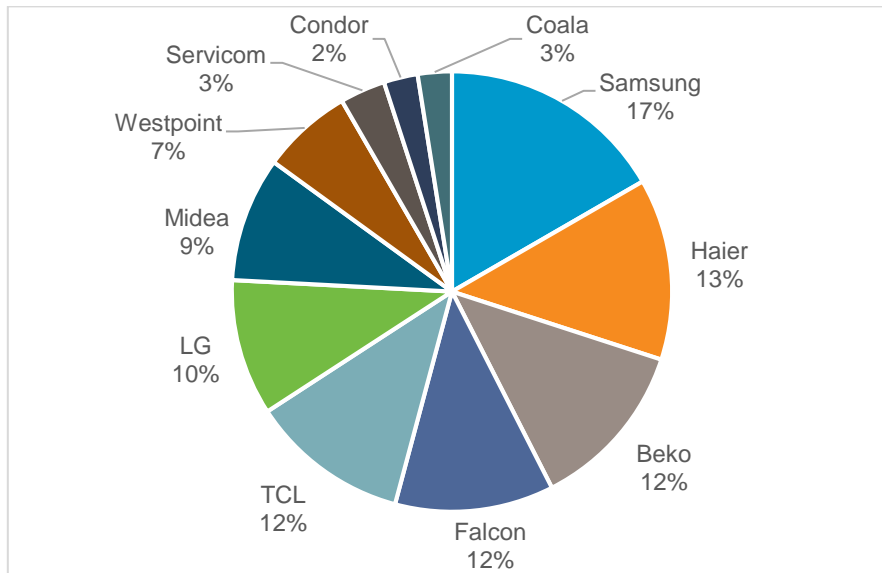
³⁸ Servicom. "Climatisation & Chauffage". 2018. <http://www.servi.com.tn/climatisation-chauffage?lang=en>

³⁹ Condor Electronics International. 2018. <http://www.condor-tunisie.tn/>

⁴⁰ World Bank. *Energy-Efficient Air Conditioning: A Case Study of the Maghreb*. World Bank Group, 2016.

origin of the brand.

Figure 45: Major AC brands in Tunisia (N=120)



10.2.3 AC Types, Functions, Capacities, and Prices

All models are split ACs with no window units observed among the 120 products found. This is in line with the report from JRAIA,⁴¹ where split ACs account for 94% of the Tunisian room AC market.

In terms of functions of ACs in Tunisia, approximately a third of the products are cooling-only models, whereas the other two-thirds offer both cooling and heating functions (Figure 46).

Only four cooling capacities are available on the Tunisian AC market: 9000 Btu/hr, 12000 Btu/hr, 18000 Btu/hr and 24000 Btu/hr. ACs with a cooling capacity of 9000 Btu/hr have a slightly higher market presence (34% among all surveyed models), whereas the other three cooling capacity categories have similar market presence at approximately 20% each (Figure 47).

Figure 46: AC functions in Tunisia (N=120)

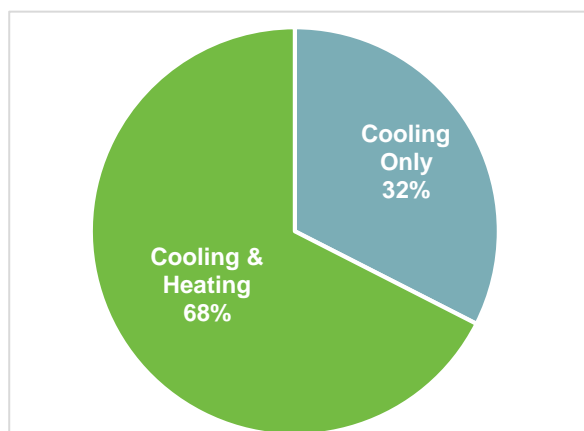
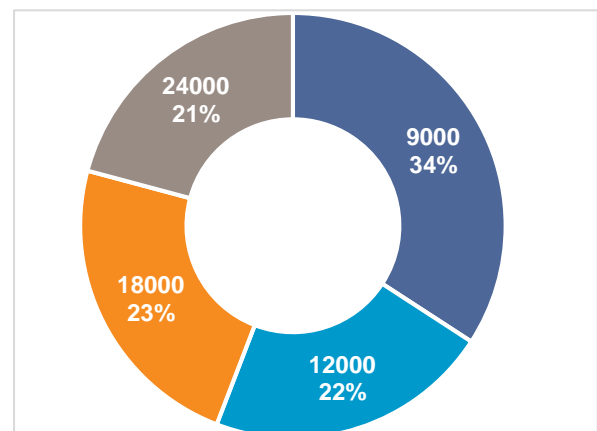


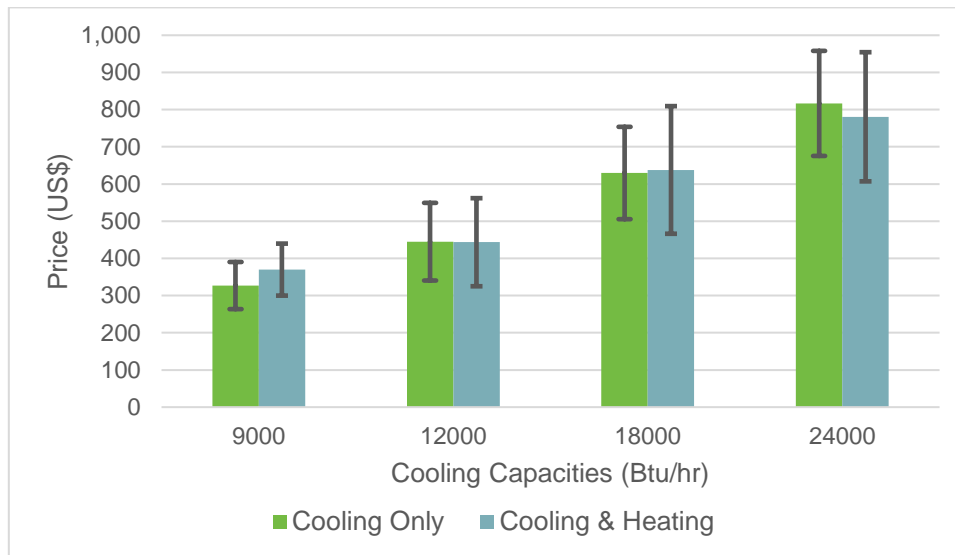
Figure 47: AC cooling capacities in Tunisia (N=120)



⁴¹ JRAIA. World Air Conditioner Demand by Region. 2017

The average prices of ACs in Tunisia range from approximately US\$ 320 for a 9000 Btu/hr model to US\$ 820 for a 24000 Btu/hr model. AC prices primarily depend on the cooling capacities (Figure 48). It appears that there is no significant price differences between cooling-only models and cooling and heating models.

Figure 48: Average prices of different capacity and different function AC units in Tunisia (N=120)

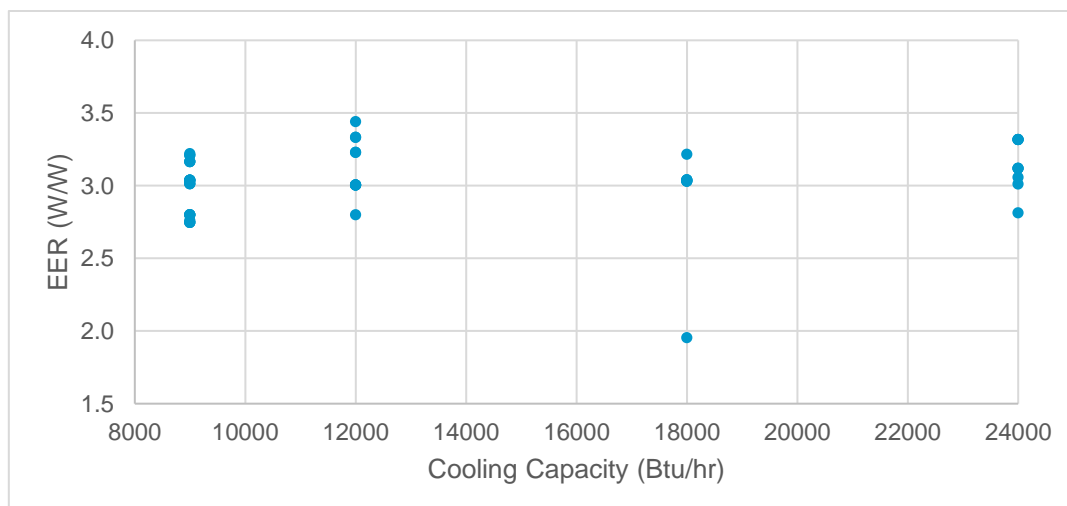


10.2.4 Energy Performance

Online shops in Tunisia rarely provide energy performance information for ACs. While EER ratings were rarely provided in the online shops, in some cases, power input data was provided. Where possible, CLASP estimated the EER ratings using the method outlined in section 6.2.4.

Tunisia has had an S&L policy for ACs below 12 kW since September 2004, with energy labels based on EU labels. Under current regulations, the MEPS for ACs is Class B (3.0 W/W) based on the repealed Directive 2010/30/EU. However, a World Bank report from 2016, notes that the energy efficiency of ACs in the country has deteriorated in recent years because cheaper and less efficient products are smuggled from neighboring countries that do not have S&L programs.⁴⁰ This might explain why the Tunisian market had a unit with the lowest EER (1.95 W/W) among all the products surveyed for this study. Figure 49 shows the EER ratings with respect to cooling capacities.

Figure 49: AC energy performance in Tunisia (N=51)



10.2.5 Availability of Inverter Technologies and Refrigerant Types

Inverter technologies are available on the market but with very limited market presence (Figure 50). The smaller brands, such as Coala, Condor, and Servicom offer inverter ACs. The only major brand that advertises inverter technology is LG. The lack of presence of inverter technology on the Tunisian market is clearly not due to technical barriers since all the major brands present in Tunisia have mature inverter technologies and products sold elsewhere in the world. A potential reason is that the investment on more expensive inverter technologies cannot be recovered in a short time since electricity tariffs are heavily subsidized in Tunisia.^{42, 43}

The majority of the products (62%) available from the online shops do not specify refrigerants used (Figure 51) ACs with R-22 refrigerants are still being sold in Tunisia. These R-22 models are mostly Samsung models.

Figure 50: Types of AC compressors in Tunisia (N=120)

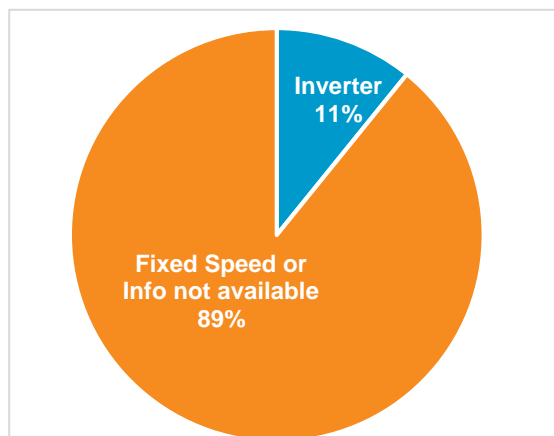
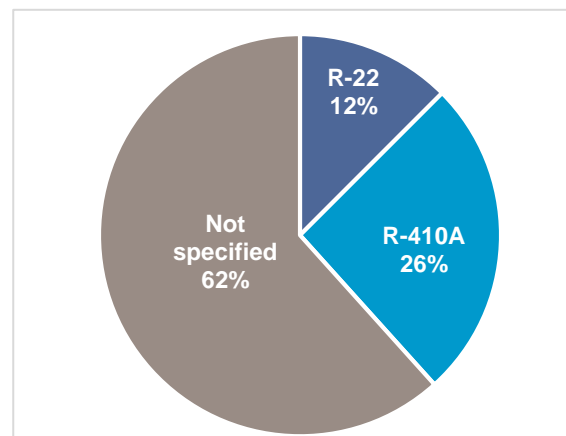


Figure 51: Types of AC refrigerants in Tunisia (N=120)



⁴² energypedia. "Tunisia Energy Situation." 2018. https://energypedia.info/wiki/Tunisia_Energy_Situation

⁴³ Average electricity prices are 167 – 198 mill/kWh or US\$ 7 – 8 cents per kilowatt hour.

Société Tunisienne de l'Electricité et du Gaz (STEG). "Les Tarifs d'électricité." January 2017. http://www.steg.com.tn/fr/clients_res/tarif_electricite.html

11 National Market Assessment – Burkina Faso

The data for Burkina Faso was sourced from a filled survey submitted by a representative from the Burkina Faso National Ozone Office. Based on authorized AC imports, the AC market size in Burkina Faso in 2016 was estimated to be approximately 23,000 units. The most popular AC brands in Burkina Faso are Sharp, LG, and Samsung. All AC units are imported, and originate primarily from the United Arab Emirates (UAE), Singapore and South Korea.

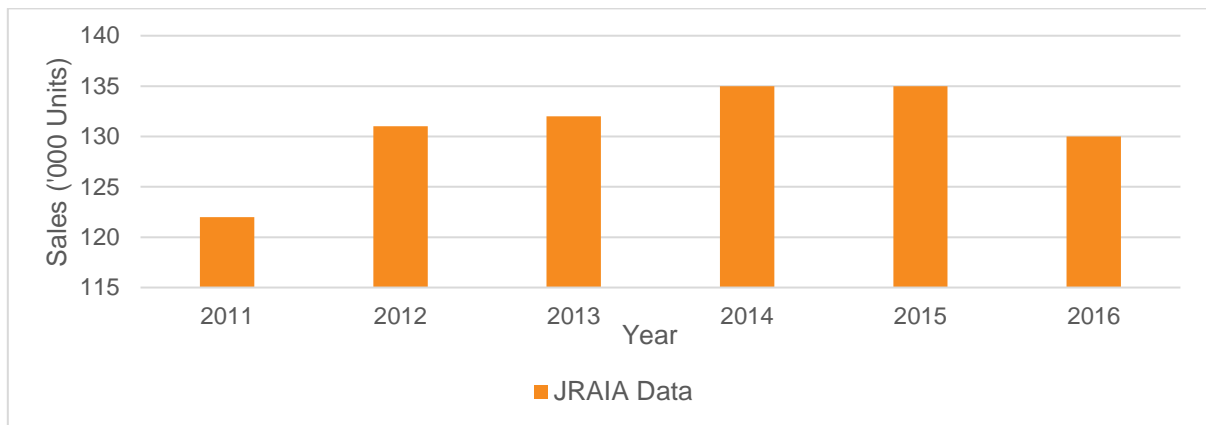
Split ACs make up 85% of the market while window ACs make up 5%, with the rest taken up by other, unspecified types. The 12,000 Btu/hr and 18,000 Btu/hr AC units are the most common sizes in this market. The average price for a 12,000 Btu/hr AC in this market is between US\$ 437 and US\$ 481, and the average price for an 18,000 Btu/hr AC is between US\$ 568 and US\$ 611.

Fixed-speed ACs make up 90% of the total AC market, with inverter ACs accounting for only approximately 10% of units. The average energy efficiency for ACs in the Burkina Faso market is 2.71 W/W. Like many countries in this study, the most common refrigerants found in ACs are R-22 and R-410A.

12 National Market Assessment – Morocco

The data for Morocco was sourced primarily from a filled survey submitted by a representative of the Ministry Of Industry, Investment, Trade and Digital Economy and complimented by market size data from JRAIA. Based on these two sources, the AC market size in Morocco is estimated to be between 130,000 and 240,000 units annually.

Figure 52: Annual AC sales in Morocco



The most popular AC brands in Morocco are LG, Carrier, and Midea. All AC units are imported and originate primarily from China, Thailand, and the United Kingdom.

Split ACs make up 70% of the overall AC market while window ACs make up 3%, with the rest taken up by portable AC units and larger ACs. The 12,000 Btu/hr AC units are the most common size in this market. The average price of an AC in this market is between US\$ 380 and US\$ 490.

Non-inverter ACs make up 70% of the ACs sold in the market, with inverter ACs taking up the rest. This might be why the average energy efficiency level of ACs in Morocco is relatively high at 3.5 W/W compared to other African countries analyzed in this report. The most common refrigerant found in ACs are R-22 and R-410A.

13 National Market Assessment – Senegal

The data for Senegal was sourced from a filled survey submitted by the Senegal National Ozone Office. The AC market size in Senegal is estimated to be approximately 39,200 units annually. The most popular AC brands in Senegal are Samsung, Filis, and LG. While Samsung and LG are South Korean brands, the country of origin of the Filis brand is unknown. All AC units are imported and originate primarily from China, Europe, and the United Arab Emirates (UAE).

Split ACs make up 90% of the market while window ACs make up 9.95%, with the rest taken up by portable AC units. The 9,000 Btu/hr, 12,000 Btu/hr and 18,000 Btu/hr AC units are the most common in this market. The average price of an AC in this market is between US\$ 321 and US\$ 753.

Inverter ACs have a low market presence in Senegal and only make up approximately 5% of the total AC market. The most common refrigerants found in ACs are R-22, R-410A and R-407C. As with other developing countries, the presence of R-22 ACs might indicate a dumping problem of ACs from countries where HCFCs are banned.

Appendix 1: Africa Air Conditioner Market Scoping Study Survey

Note: Please refer to the examples in *grey italics* to complete this survey.

Africa Air Conditioner Market Scoping Study Survey	
Name	<i>e.g. Mr. John Smith</i>
Position and Organization	<i>e.g. National Ozone Officer, Ministry of Environment</i>
Country	<i>e.g. Ghana</i>
Date	<i>e.g. November 20, 2017</i>




1. What are the top three most popular air conditioner brands?

Brand 1: *e.g. LG*

Brand 2: *e.g. Daikin*

Brand 3: *e.g. Midea*

2. Please indicate the approximate market share of each type of ACs below:

Air Conditioner Type	Approx. Market Share	Picture
Split AC	<i>e.g. 70%</i>	
Window AC	<i>e.g. 15%</i>	
Portable AC	<i>e.g. 5%</i>	
Other Type	<i>e.g. 10%</i>	<i>Please Describe or include a picture</i>

3. What is the most popular cooling capacity for air conditioners? (Please specify units, i.e. in ton, kW or BTU/hr)

e.g. 1.5 ton; or

e.g. 3.5kW; or
e.g. 12,000 BTU/hr

4. What is the average energy efficiency level for air conditioners? (Please specify energy efficiency metrics and units)

e.g. EER 2.71 W/W; or
e.g. EER 9.2 BTU/W; or
e.g. SEER 4.1 W/W;

5. What is the average price (or price range) of air conditioners in your country? (Please specify currency and amount)

e.g. GH¢ 3000; or
e.g. GH¢ 2500 – 4000;

6. What is the most popular type of refrigerant used for air conditioners in your country?

e.g. R-410A; or
e.g. R-32;

7. Approximately, what are the market shares of fixed speed ACs and inverter ACs (variable speed drive)?

e.g. Fixed speed ACs 60%; Inverter ACs 40%

8. Approximately, what are the market shares of imported ACs and locally manufactured ACs?

e.g. Imported ACs 90%; Locally manufactured 10%

9. Where do the imported ACs come from? Please rank by market share or popularity.

Country 1: *e.g. China*

Country 2: *e.g. Japan*

Country 3: *e.g. UK*

10. Approximately, what is the annual sales of air conditioners in your country?

e.g. 200,000 units per year

11. On average, how many hours do people normally use air conditioners every day?

e.g. 4 hours day

12. Approximately, how many days in a year do people normally use air conditioners for cooling? (please also include short explanation)

e.g. 270 days; use air conditioners year-round except for three months of raining season

13. What is the average residential electricity price?

e.g. GH¢ 1/kWh