DOMESTIC REFRIGERATING APPLIANCE AND ROOM AIR CONDITIONER MARKET AND FEASIBILITY ASSESSMENT

Rwanda Cooling Finance Initiative (RCOOL FI)

FINAL REPORT
February 2020

Authors: Hype Project Developers

For: Basel Agency For Sustainable Energy (BASE) and United for Efficiency (U4E)
With the support from:

KIGALI COOLING EFFICIENCY PROGRAM

U4E United for Efficiency

EUCL ENERGY UTILITY CORPORATION LIMITED

DEVELOPMENT BANK OF RWANDA BRD We empower you

BASE Driving investment in sustainable energy

AKNOWLEDGMENTS

The market and feasibility assessment is the result of the collaboration between the Ministry of Environment (MoE), the Ministry of Infrastructure (MININFRA), UN Environment's United for Efficiency Initiative (U4E), Rwanda Environment Management Authority (REMA), Rwanda Standards Board (RSB), Development Bank of Rwanda (BRD), Rwanda Energy Group (REG), Kigali Cooling Efficiency Program (KCEP), Government Officials, Department Heads, and experts from the Ministry of Environment, the Basel Agency for Sustainable Energy (BASE), and Hype Project Developers (HPD). It is one of the core elements of the Rwanda Cooling Initiative that was launched in 2017 to accelerate Rwanda's transition to more sustainable cooling solutions.

DISCLAIMER

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF IMAGES

ABBREVIATIONS

AC	Air Conditioner
BASE	Basel Agency for Sustainable Energy
BNR	*National Bank of Rwanda*
BRD	Development Bank of Rwanda
CFCS	Chlorofluorocarbons
EUCL	Energy Utility Corporation Limited
F-GASES	Fluorinated gases
GWP	Global Warming Potential
HCFCS	Hydrochlorofluorocarbons
HFCS	Hydrofluorocarbons
ODP	Ozone Depletion Potential
ODS	Ozone Depleting Substances
RCOOL	Rwanda Cooling Initiative
REG	Rwanda Energy Group
REMA	Rwanda Environment Management Authority
SPSS	Statistical Package for the Social Sciences
TFA	Trifluoroacetic acid
U4E	United for Efficiency initiative

EXECUTIVE SUMMARY

Demand for cooling and refrigeration in Rwanda is projected to soar as the population and economy continue to grow amidst a warming climate: the number of household refrigerators, air conditioners (ACs) and fans is expected to increase substantially in the next 15 years[1].

The Market and Feasibility Assessment (hereinafter referred to as "Market study") by the Rwanda Cooling Initiative (RCOOL) has been conducted to gain a deep understanding of the domestic and light commercial cooling appliance market in Rwanda, and the potential for energy efficient cooling appliance technologies. It will underpin the development of a financial mechanism that aims to accelerate the switch to more energy-efficient and climate-friendly cooling solutions as part of the next phase of RCOOL, called the Rwanda Cooling Finance Initiative (RCOOLFI). In the initial phase of RCOOL, a new leasing scheme called *Coolease* was introduced, which primarily targeted major users of cooling in the commercial and public building sector. RCOOLFI aims to promote an additional financial mechanism opportunity that targets the residential and light commercial sector which are more modest users of cooling and have different considerations and viable technologies.

The targeted population of the study consisted of suppliers and retailers, financial institutions, households and Governmental institutions. The results are based on a combination of household surveys, stakeholder interviews, and desktop research to provide a clear understanding of the cooling market in the residential and light commercial sector. The study sampled respondents who are categorized into low-, medium- and high-income earners in urban districts within Kigali City, Huye in Southern province, Musanze in Northern province, Rubavu in Western province and Nyagatare in Eastern province.

According to the Population and Housing Census (2012) 39,750 households possessed refrigerators and freezers in Rwanda. Due to economic growth from 2012 to 2019 and a significant expansion of electrification from 54 per cent to now about 70 per cent[2], it is estimated that there has been a steady increase of these appliances in the market. The study established that Kigali city leads with 30,155 refrigerator owners, followed by Southern Province with 23,389, Western Province with 17,341, Eastern province with 16,052 and finally Northern with 10,575 refrigerators. This makes a total of 97,512 refrigerators in Rwanda. However, the previous census did not differentiate between the type of product (e.g.

[1] Rwanda Podium. ENVIRONMENT: Rwanda's New Cool Endeavour. http://rwanda-podium.org/index.php/actualites/politique/3586-environment-rwanda-s-new-cool-endeavour. (Accessed on 22 July 2018)

[2] MININFRA (2015b). *Energy Sector Strategic Plan*. Available online at: http://www.mininfra.gov.rw/fileadmin/user_upload/new_tender/Energy_Sector_Strategic_Plan.pdf

refrigerators, refrigerator-freezers, or freezers), so hereinafter these are grouped together as refrigerating appliances.

The findings indicate that the best potential residential market segments are medium-income household with about 66.3 per cent market share and high-income households controlling about 23.2 per cent of the market share including micro entrepreneurs from urban areas controlling about 26.9 per cent (Figure 13). It is clear that very few households in Rwanda own ACs or fans and growth trajectories appear limited outside of the small but growing demand in the commercial sector. Many low-income earners do not have refrigerators and ACs because it is a luxury commodity that they simply cannot afford. Although most of the refrigerators found in households are new (58.6 per cent were bought less than three years ago), there is a large number, (36 per cent) which is approximately 35,104 households who purchased their refrigerating appliances more than 4 years ago and may still use potent gas. The outlets selling the highest quantities of these appliances are supermarkets and brand representative shops.

The study reveals that about 97.7 per cent of the household respondents own a bank account. This shows that there is high financial inclusion among the medium-income and the high-income earners in Rwanda. 83.3 per cent of the respondents have bank accounts in commercial banks while 11.9 per cent bank with microfinance institutions. 90.1 per cent of the households use mobile banking meaning that it is more convenient to involve commercial banks and use mobile customer interface for effective and efficient financial transactions when developing a target financial mechanism for RCOOLFI.

Nonetheless the study revealed there are some financial and technical barriers which would need to be addressed to accelerate the transformation of the market towards energy-efficient cooling equipment. For the end-users, they pay high upfront cost, there is lack of trust that the product will achieve energy performance / payback claims and also lack of awareness on energy savings in the long run. For financial institutions, increasing green financing would require to minimise risk of financial non-performance, resolving the question of defaulting on payment, and clarifying a debt recovery strategy for the acquired energy-efficient cooling appliances. For the technology providers, some of the issues in questions were about how to minimise defaulting and the issue of replacement of new refrigerators. These findings help to identify the significant life-cycle cost of ownership savings that can be realised by purchasing products that are more expensive to purchase but cost far less to operate due to lower electricity bills.

I. METHODOLOGY

The study used mixed method design to collect primary and secondary data and provide a more comprehensive approach of collecting the information. The results of this report are based on a combination of desktop research, household survey, and interviews to form a picture of the market. Key stakeholders were consulted including households, technology providers, financial institutions, and government institutions (see Appendixes).

The study targeted 425 households and out of this number 351 questionnaires from the households covering the main urban areas in Rwanda, including Kigali city, Huye in Southern province, Musanze in Northern province, Rubavu in Western province and Nyagatare in Eastern province were able to correctly fill the questionnaire for analysis indicating that the study attained 83 per cent response rate. These areas represent the highest market potentials for the replacement of old domestic cooling appliances (see chapter 2.)

II. ANALYSIS OF THE DEMAND SIDE

2.1 Household characteristics and financial capabilities in Rwanda

Understanding household characteristics and financial capabilities in Rwanda was important to design the household sample and later inform the process of selecting and developing financial mechanisms for the replacement of old refrigerators and ACs in the residential and light commercial sectors, therefore matching the market demand.

According to the Fourth Rwanda Population and Housing Census (RPHC4), Rwanda accommodates a total number of 2.42 million private households in 2012. Some of these households possess specific assets and their corresponding resident population by area of residence as indicated in the table below.

Table 1: Refrigerators/Freezers

Household assets and Area of residence	Total population	Total number of households	No of households with refrigerators	Percentage of households with refrigerators
Rwanda	10,378,021	2,424,898	39,750	1.6%
Urban	1,678,786	416,779	35,342	8.5%
Rural	8,699,235	2,008,119	4,408	0.2%

Source: Fourth Population and Housing Census (RPHC4), Rwanda, 2012

The statistics indicates that 1.6 per cent of Rwanda's households owned refrigerators, representing at least a market size of 39,750 units in 2012, while the highest share of the

population with refrigerators (8.5 per cent) came from households living in urban areas, representing the highest market segment, that is at least about 35,342 units.

Regarding the different urban market segments, the highest numbers of households with refrigerators were observed in Kigali City and in the Southern Province, while the lowest in Northern Province, as indicated in the table below.

Table 2: Percentage of private households possessing Refrigerator /Freezer by province and area of residence

Province and Area of residence	Refrigerator /Freezer
Kigali City (Urban)	13.4%
South (Urban)	3.9%
West (Urban)	3.2%
North (Urban)	2.6%
East (Urban)	2.8%

Source: Fourth Population and Housing Census (RPHC4), Rwanda, 2012

The present study sampled 43.2 per cent households in Kigali city, 14.2 per cent households in southern province, 14.2 per cent households in western province, 14.2 per cent households in northern and 14.2 per cent households in Eastern province. The geographic distribution of households in secondary cities was homogeneous because of similarity in settlement and also due to the fact that the population of the household ranges within the average of 80,000 according to RPHC4 report. A highest weight was given to household living in Kigali City to reflect the results of RPHC4, see table below.

Table 3: Households with refrigerators per province

Province and Area of residence	Total HH	HH with refrigerators	Refrigerator /Freezer
Kigali City (Urban)	225,039	30,155	0.13
South (Urban)	599,729	23,389	0.04
West (Urban)	541,919	17,341	0.03
North (Urban)	406,712	10,575	0.03
East (Urban)	573,270	16,052	0.03

Due to constant economic growth from 2012 to 2019 and a significant expansion of electrification from 54 per cent to now about 70 per cent, the study estimates that there is a steady increase of refrigerators owned by households in the market. The study established that Kigali city leads with 30,155 refrigerator owners, followed by Southern Province with 23,389, Western Province with 17,341, Eastern province with 16,052 and finally Northern with 10,575 refrigerators. This makes an estimated total stock of 97,512 refrigerators in Rwanda in 2019.

Table 4: Estimated stock of refrigerators owned by households in Rwanda, 2012 - 2019

Year	Total stock of refrigerators	No of households	Percentage of households with refrigerators
2012	39,750 (census)	2,424,898 (census)	1.6% (census)
2013	48,002	2,497,645	1.9%
2014	56,254	2,572,574	2.2%
2015	64,505	2,649,752	2.4%
2016	72,755	2,729,244	2.7%
2017	81,009	2,811,121	2.9%
2018	89,260	2,895,455	3.1%
2019	97,512	2,982,319	3.3%

Moreover, information concerning household income distribution and categorization of income level is important, because it sheds light on the market segmentation based on capability of the household to own energy-efficient cooling appliances.

Table 5: Geographic representation of sampled respondents

Province and Area of residence	Sampled households	Percentage
Kigali City (Urban)	153	43.2 %
South (Urban)	50	14.2 %
West (Urban)	50	14.2 %
North (Urban)	50	14.2 %
East (Urban)	50	14.2 %

In February 2015, the Ministry for Local Government and Social Affairs launched a new categorization for Ubudehe to assess the general economic status of Rwandans (MINALOC 2015). Ubudehe is a program launched in 2001 as part of partnership between the Ministry of Finance and Economic Planning and the Ministry of Local Government in a bid to draft the Poverty Reduction Strategy Paper (PRSP).

Table 6: Ubudehe Categorization key data by province

Province and Area of residence	CAT 1	CAT 2	CAT 3	CAT 4	Total HHs
Kigali City	26,136	98,864	92,938	7,101	225,039
South	136,991	323,410	137,324	2,004	599,729
West	92,980	298,802	147,566	2,571	541,919
North	48,033	224,762	132,303	1,614	406,712
East	60,431	257,246	252,404	3,189	573,270
Rwanda	364,571	1,203,084	762,535	16,479	2,346,669
Percentage (%)	15.5%	51.3%	32.5%	0.7%	100%

Source: MINALOC 2015.

Category 1: Very poor and vulnerable citizens who are homeless and unable to feed themselves without assistance.

Category 2: Citizens who are able to afford some form of rented or low class owned accommodation, but who are not gainfully employed and can only afford to eat once or twice a day.

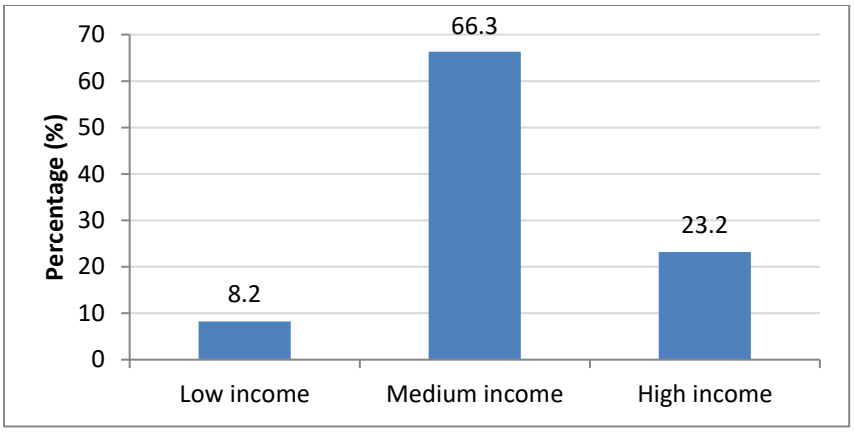
Category 3: Citizens who are gainfully employed or are even employers of labour. Within this category are small farmers who have moved beyond subsistence farming, or owners of small and medium scale enterprises.

Category 4: Citizens classified under this category are chief executive officers of big businesses, employees who have full-time employment with organizations, industries or companies, government employees, owners of lockdown shops or markets and owners of commercial transport or trucks (Government of Rwanda 2015; MINALOC 2015).

This study sampled responses from households in category 2, 3 and 4, but more emphasis was put on category 3. This study thus targets mainly medium- and high-income households from urban areas, which are households considered having higher probability of owning a refrigerator and/or an AC according to these national statistics. At the opposite, the majority of low-income earners is likely not to own a refrigerator or may not consider acquiring a new energy-efficient refrigerator as a priority because of the competing needs and demands like the basic needs for food and shelter.

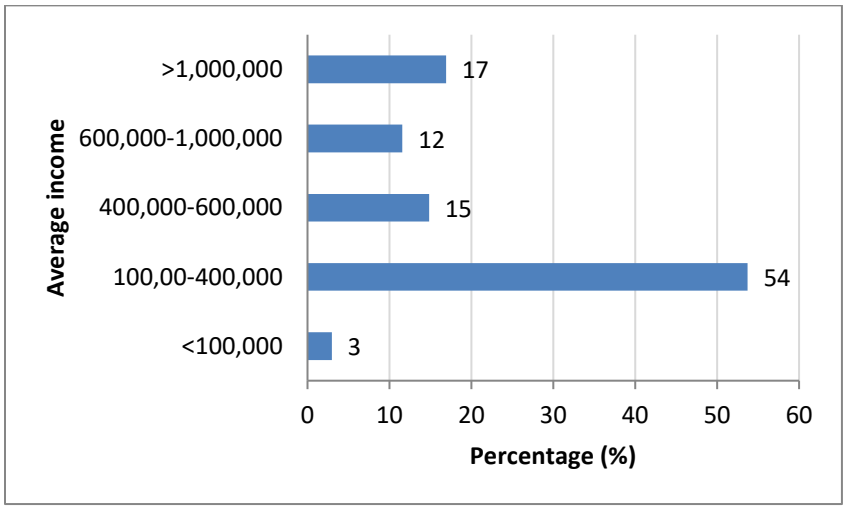
In particular, using African Development Bank (AfDB) criteria to rate income status of the residents, the study indicates that 66.3 per cent of the residents were medium-income earner, 23.2 per cent were high-income earners and 8.2 per cent were low-income earners, see table above. AfDB definition focuses only on the African continent and defines middle-class status as someone living on $2-$20 a day. This means that households living with less than $2 fall under low-income earners whereas those living above $20 can be categorized as high-income earners. This group is capable of sustaining a strong demand base for products including services.

Figure 1: Income distribution of sampled respondents



The study reveals that 81 per cent of the respondents at the household level earn between Rwf 100,000 to Rwf 600,000, which is about $108 to $650 per month, as shown in the figure 2 below. These are mostly medium-income earners and some high-income earners marked by changing lifestyles, greater spending power, more recreational time, and harnessing of new technology.

Figure 2: Average household monthly income

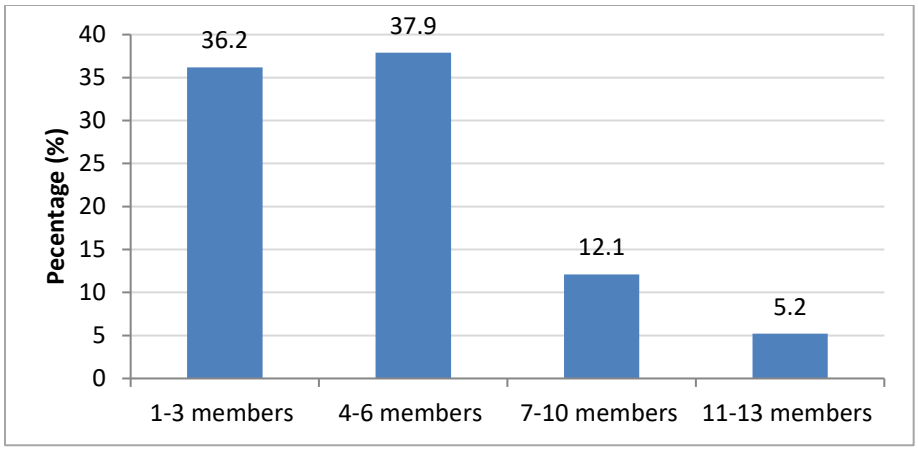


2.2 General information on households

2.2.1 Household size

It was observed that more than 74 per cent of the households who fall under the bracket of mid- and high-income earners have small families of less than 5 people. A small family size includes an average of three siblings.

Figure 3: Household size

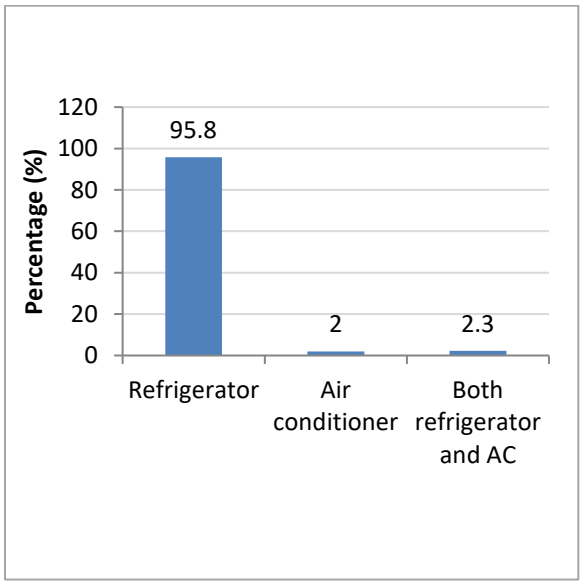


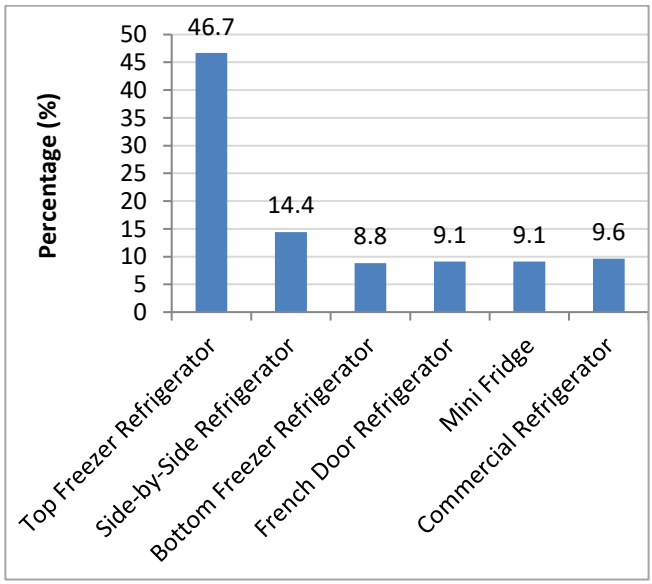
2.2.2 Owned household appliances

It is observed that 95.8 per cent of the sampled households possesses a refrigerator, 2 per cent own an AC (mainly fans) while 2.3 per cent own both appliances. It is clear that very few households in Rwanda own ACs and therefore the best market opportunities are for refrigerators.

The survey also indicates that the most common types of refrigerators owned by households are top freezer refrigerators (46.7 per cent), then side-by-side refrigerators (14.4 per cent). Top-freezer refrigerator is usually the cheapest and most energy-efficient option compared to other types in the market. Also, households prefer this type of fridge because it usually offers more storage capacity.

Figure 4: Owned household appliances

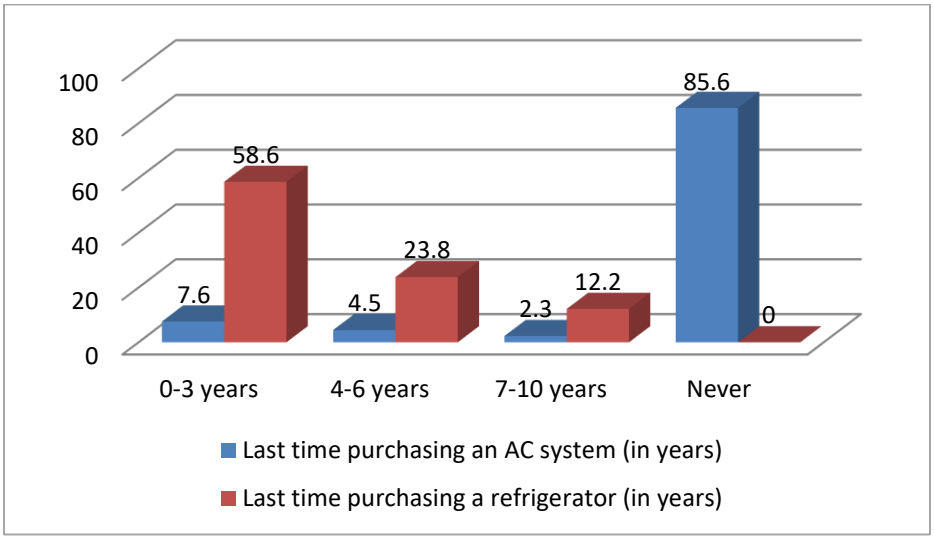




2.2.3 Age of owned cooling equipment (in years)

85.6 per cent of respondents have never owned an AC, as shown in the figure below. Whereas respectively 58.6 per cent declared buying a refrigerator less than three years ago, 23.8 per cent between 4-6 years ago, and 12.2 per cent nearly 10 years ago. Although most of the refrigerators found in households are new, there is a large number that still uses potent refrigerant gas.

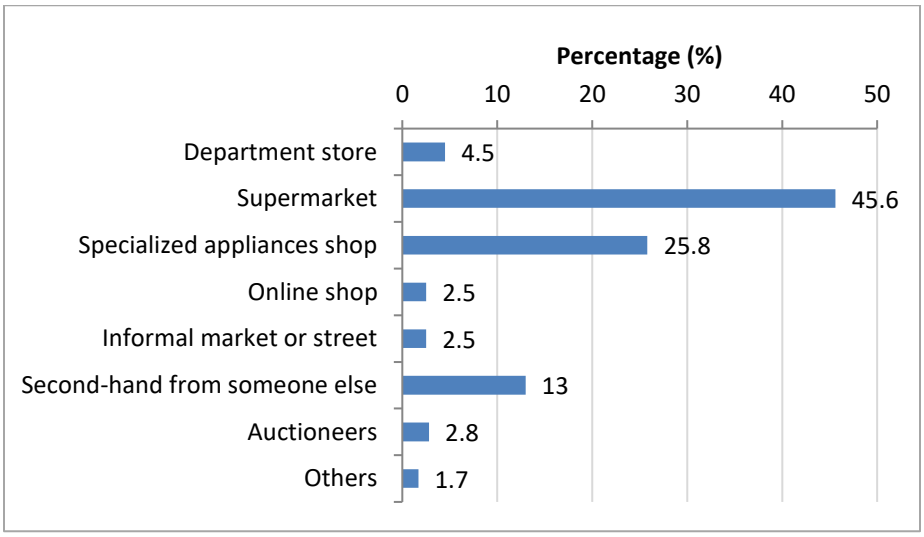
Figure 5: When did households buy their refrigerator or AC (in years)?



2.2.4 Purchase point for AC or refrigerator

It was observed that 45.6 per cent of the household appliances were bought from supermarkets while 25.8 per cent were from specialized appliances shops. Many people, especially from the middle-income class prefer shopping from a centralized area. It implies that most of the suppliers have physical addresses where a consumer may go and purchase any electronic appliances of his/her choice. Online shopping is still relatively low (2.5 per cent), but it has increased in popularity in Rwanda over the past couple of years.

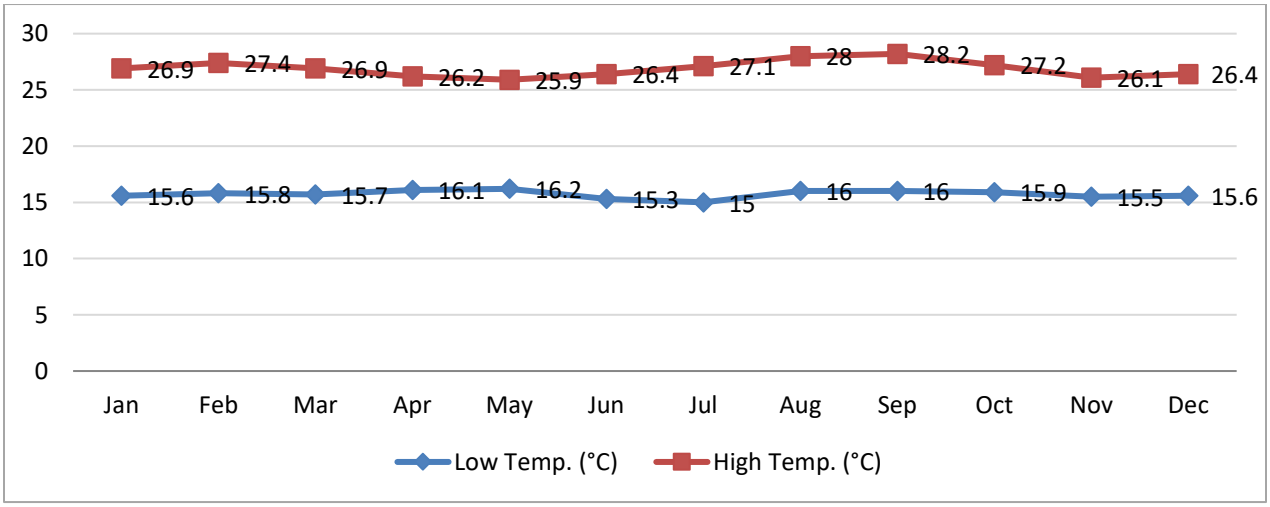
Figure 6: Where did households buy their refrigerator or AC?



2.2.5 Owned appliances per household income level

The survey indicates that households in all the three income level clusters own at least a refrigerator. Medium-income households declared owning the greatest number of refrigerators, while low-income earners declared owning the lowest number of refrigerators.

Figure 7: Average Temperatures in Rwanda



Source: MINIRENA 2018

2.2.6 Housing status and characteristics

The study indicates that more than 59 per cent of the surveyed households in Rwanda range between 101 to 200 square metre in size, as sown in table below. These are big houses which have enough ventilation and would require an AC. It was observed that 96.3 per cent of Rwandan houses have zero floors likely because most of the surveyed residential areas are

developed with modern construction complying with the new District Development plan/Physical Plan.

Table 7: Housing status and characteristics

Description	Variables	Frequency	Percentage (%)
House size (m^2)/number of rooms	21-40 m^2	8	2.3
	41-60 m^2	14	4.0
	61-80 m^2	54	15.3
	81-100 m^2	65	18.4
	101-150 m^2	139	39.4
	150-200 m^2	73	20.7
Number of Floors	Zero floors	340	96.3
	One Floor	13	3.7
Household ownership	Yes	231	65.4
	No	122	34.6
Number of times a household have changed addresses in the last 5 years	Zero	226	64.0
	1-3 times	122	34.6
	4-7 times	5	1.4

The study indicates that 65.4 per cent of the sampled household respondents own their homes. According to EICV5, majority of households in Rwanda in 2016-17 own their dwellings (76.5 per cent), while (17 per cent) live in rented dwellings. In general, respondents who own their houses consider them as their permanent residential addresses and therefore have no reason to move. From the survey, it is observed that 64 per cent of the respondents declared that they have not changed addresses in the last five years, while 34.6 per cent have changed their addresses about three times. The homeowners are able to use their properties as collaterals to seek better loans from financial institutions. That is a segment of the population, which might thus be prioritized to avoid loan repayments tracking issues and thus make the financiers feel more comfortable with default risk.

2.3 General Information on household finance

This section provides information about the level of financial inclusion at the household level. This will inform the selection and development of financial mechanisms to meet household finance preferences in order to increase adoption of energy-efficient products and help financial institutions build a project pipeline for investment in energy efficient cooling equipment.

Table 8: General Information on household finance

Description	Variables	Frequency	Percentage (%)
Household access to	Yes	345	98.3

bank account	No	6	1.7
Type of financial institution/bank	Commercial banks	294	83.3
	Microfinance institutions	42	11.9
	Others	17	4.8
Type of bank account	Current account	226	66.5
	Savings account	56	16.5
	Fixed account	1	0.3
	Both Current & Saving accounts	47	13.8
	Both current and fixed accounts	5	1.5
	Both Savings and Fixed Accounts	5	1.5
Access to loan	Yes	197	57.1
	No	148	42.9
Repayment period (tenor) of the loan	0- 1 year	16	4.5
	1- 3 years	93	26.3
	3- 6 years	54	15.3
	6- 10 years	30	8.5
	> 10 years	11	3.1
	Others	149	42.2
Credit card owners	Yes	123	35.9
	No	220	64.1
Use of mobile banking solutions	Yes	318	94.4
	No	19	5.6

2.3.1 Household access to bank account

The study reveals that about 98.3 per cent of the respondents own a bank account. This shows that there is high financial inclusion among the middleclass and the high-income earners in Rwanda. Financiers will feel more comfortable lending to households with a solid customer and credit history. Access to financial services in Rwanda is currently driven by two major types of services – Savings and Credit Co-operatives (SACCOs) and mobile phone-based financial services known as mobile money offered by both commercial banks and microfinance institutions. Rwanda's Vision 2020 outlines an ambitious development plan, which aims to transform the country into a knowledge-based, middle-income country, a tech and financial hub for the region and a cashless economy. A strategy to develop an inclusive and interoperable payments system is seen as core to meeting financial inclusion targets and supporting higher levels of economic activity. The Central Bank of Rwanda (BNR) is pushing the industry to learn and grow through experimentation, even encouraging failure as part of the learning cycle.

2.3.2 Type of financial institution/bank

The study also reveals that 83.3 per cent of the respondents have bank accounts in commercial banks while 11.9 per cent deal with microfinance institutions meaning there is

95 per cent financial inclusion and that it is more convenient to liaise with commercial banks when developing financial mechanisms to target the medium- and high-income earners who are the highest potential segments of the target market. Nearly all financial institutions operating in Rwanda have a deposit-taking license and come under the supervision of the BNR. Formal access to savings is more common than access to credit.

2.3.3 Type of bank account

Majority of the household respondents (66.5 per cent) operate current accounts in commercial banks. It means that most people prefer current accounts as compared to savings accounts. This may be due to the fact that a savings account is a deposit account and allows limited transactions, while a current account is meant for daily transactions. In terms of sustainability, savings accounts are most suitable for people who are salaried employees or have a monthly income, whereas current accounts work best for traders and entrepreneurs who need to access their accounts frequently.

According to national statistics, there are five times more deposit accounts than there are borrowers and some studies[3] suggest that only few adults have access to credit from a bank. For instance, the majority of commercial banks have not managed to penetrate rural areas, commercial and microfinance bank branches being mostly located within the urban areas.

2.3.4 Access to loan

It was observed that a majority of the respondents (57.1 per cent) have already accessed loans from a commercial bank. However, a sizable number of households in Rwanda fail to get loans due to strict due diligence and eligibility barriers. Loan approval is generally based on a thorough credit risk assessment including factors such as borrower's financial capacity, own capital, availability of collaterals, credit score, etc.

2.3.5 Loan repayment period (tenor)

For those who have ever accessed the loans, more than 41 per cent indicated that the tenor of loan ranged between 1-6 years. This would give some flexibility to lower monthly loan repayment that would still satisfy both household preferences and financiers' expectations.

2.3.6 Credit card owners

The study also indicates that credit card ownership (35.9 per cent) is not common among household respondents. This is due to unawareness of using credit cards, high minimum

[3] http://finclusion.org/country/africa/rwanda.html

requirements demanded which may not be attained by majority and lacks of trust in credit card technology. Other factors may include lack of consolidation of technology and process and also lack of reliable non-cash payment technology/infrastructure. As of 2018 BNR statistics indicated that there were 3,768 credit cards as compared to 945,262 debit cards deployed by Rwanda's banks[4].

2.3.7 The use of mobile banking solutions

It was found that 94.4 per cent of the respondents use mobile banking services solutions to access financial services in their respective financial institutions. Banks and mobile money providers have made efforts to form bilateral agreements to facilitate account to account (A2A) transfers as well as ATM withdrawals. To drive customer adoption and usage, providers have been introducing beyond-payment products and services. Banks have invested in building their own Unstructured Supplementary Service Data (USSD)-based mobile banking services. USSD allows users without a smartphone or data/internet connection to use mobile banking through the **123#* code. USSD-based mobile banking can be used for fund transfers, checking account balance, generating bank statement, among other uses. They are also working to grow their own agent networks, with plans to extend their footprint into rural areas.

Mobile payment is also by far the preferred payment method for household electricity bills. As per March 2018, there were 10.1 million active mobile money subscribers in Rwanda[5]. Mobile payment solutions might be explored to facilitate households' loan repayments and ease the interaction between end-users, local providers and the local financial institutions in the market.

2.4 Existing technologies

A large majority of household respondents (88.4 per cent) stated that they purchased their refrigerators from local suppliers, while 6.4 per cent imported them directly (see Table 9). For instance, people travelling abroad (mainly China and Dubai) buy home appliances and ship them back home. A majority of the households (89.1 per cent) purchased their refrigerators new, while 10.2 per cent purchased used systems. More than 51 per cent were purchased within less than three years ago, while about 46.2 per cent were purchased between 4 to 10 years ago., but only 2.5 per cent are above 10 years.

In general, the upfront costs are higher for new systems than for old systems. New systems require no or very few maintenance expenses. 75 per cent of respondents declared paying about 100,000 to 400,000 Rwandan francs to acquire their refrigerator. Prices of refrigerators depend on many factors such as the technology, the brand, the type, the size, the energy

[4] BNR statistics. Monetary Policy and Financial Stability Statement, 30 August 2018
[5] https://www.newtimes.co.rw › news › who-delaying-mobile-money-operation

efficiency, etc. For instance, a mini fridge might cost less than Rwf 150,000, while a large double door refrigerator can go up to Rwf 2 million.

Table 9: Purchasing Information of refrigerator appliances

Description	Variables	Frequency	Percentage (%)
Purchase Origin	Local supplier	290	88.4
	Importer based	21	6.4
	Overseas	3	0.9
	Other	14	4.3
Age of unit (years)	0-1 years	28	9.5
	1-3 years	152	51.5
	3-6 years	75	25.4
	6-10 years	30	10.2
	> 10 years	10	3.4
Cost of purchasing refrigerator cost (Rwf)	0-100,000	8	2.5
	100,00-400,000	240	75.0
	400,000-600,000	61	19.1
	600,000-1,000,000	7	2.2
	>1,000,000	4	1.3
Condition of refrigerator when bought	Used	36	10.9
	New	293	89.1

2.5 Domestic cooling use and energy costs

It was found that 96 per cent of the households use prepaid meters (see Table 10). The only electricity provider in Rwanda is EUCL, which is a part of the state-owned Energy utility, Rwanda Energy Group (REG). Every house (or apartment complex) has a little electricity meter installed, where you fill up with pre-paid electricity credit, also known as 'cash power' (see Image 1).

Table 10: Household electricity consumption and metering

Description	Variables	Frequency	Percentage %
Type of electricity meter	Prepaid meter	336	96.0
	Smart meter	12	3.4
	Property shared meter	2	0.6
Preferred payment method for electricity bills	Cash	41	11.6
	Mobile payment	226	64.0
	Other	8	2.3
	Either cash or Mobile payment	77	21.8

Image 1: Cash Power used in Rwanda

The study reveals that the majority of household respondents (more than 64 per cent) uses mobile payment model to pay for their electricity bills. Both MTN and AIRTEL carriers enable to buy electricity through their mobile money services, thus one can top-up their meter without leaving the house.

Cash power can also be purchased using cash through a cash power vendor. This is an online transaction, which allows a specific vendor to sell Prepaid Electricity Tokens over the Internet. To buy cash power, households have to write down the 11-digit meter number (written on the box) and take it to a cash power vendor. All big supermarkets will also have a cash power counter, but some vendors are found at random places throughout the city.

In its endeavour to embrace the Rwandan Government orientation to go digital when it comes to service provision, Rwanda Energy Group (REG) has put in place a public database to check bills and payment details for all post-paid customers. A simple entry of the customer identification number will allow viewing all the information needed. With this tool, post-paid customers will get all information related to their payment without waiting for monthly invoices or going to their respective branches.

2.5.1 Average monthly electricity consumption (kWh)

The study indicates that the average monthly consumption of power per household ranges between 20-90 kWh per month as indicated by more than 76 per cent of the household respondents, as shown in the table below.

Table 11: Average monthly electricity consumption (kWh)

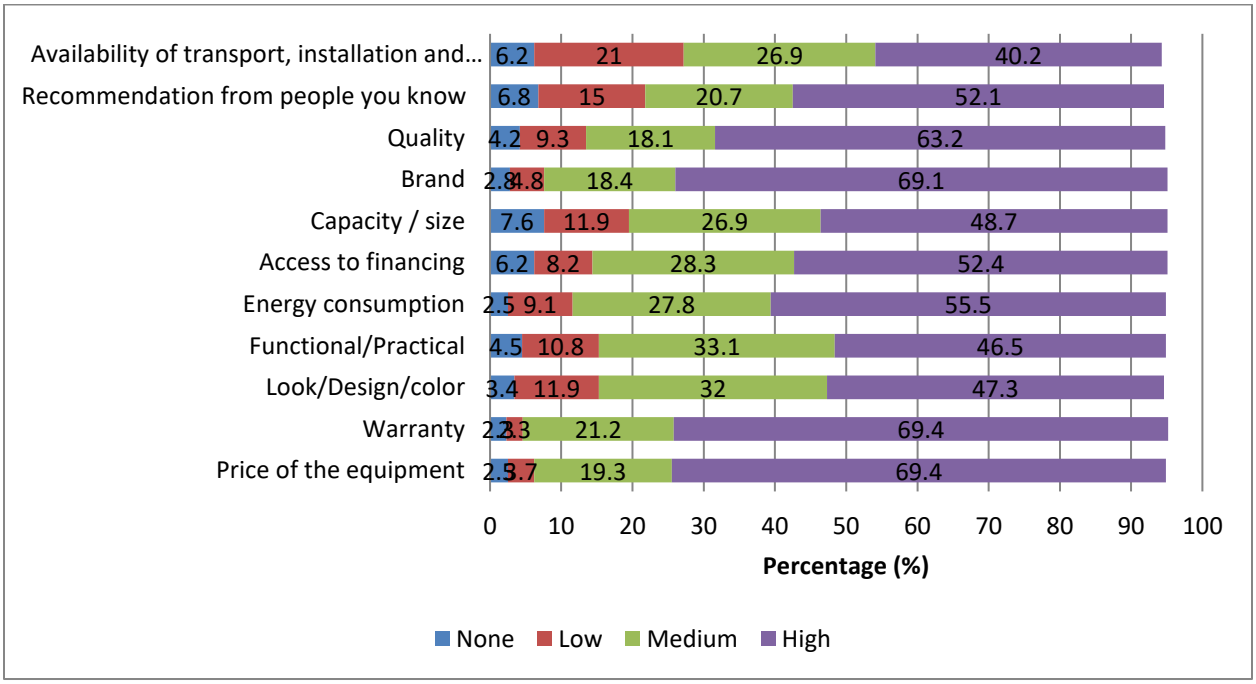
Description	Variables	Frequency	Percentage (%)

Average monthly electricity consumption (kWh)	<20 kwh	23	6.6
	20-50 kWh	156	44.4
	60-90 kWh	115	32.8
	100-130 kWh	34	9.7
	>130 kWh	23	6.6

However, the majority of household respondents do not exceed 50 kWh per month. The amount a family spends varies at large scale. However, for households, it is more common to express the consumption of power in days or money, not in kWh. A household owning multiple home appliances (e.g. TV, washing machine, iron, etc.) may spend Rwf 80 000 per month, whereas a family with no home electronics, but just a lamp and a phone to charge, spends Rwf 3000 per month.

Or, sometimes it takes 5 days to end the cash power, sometimes it lasts for 8 days. A cash power of Rwf 500 or 2.2 KWh can take an average of 1 day for household having a mini-fridge and few electronic like TV, iron box, laptop, lamp and a phone to charge. This difference makes people wonder where all the money got spent and how to optimize the use of owned appliances. Therefore, pre-paid metering makes people more conscious about energy consumption.

Figure 8: Factors to consider before deciding to purchase a refrigerator



2.6 Factors to consider before deciding to purchase a refrigerator

The survey reveals that the most important factors that households consider before acquiring a refrigerator are the price, the warranty, the brand, the quality, and the energy efficiency.

Access to finance is not one of the strongest barriers for medium- and high-income earners from urban areas.

III. TECHNOLOGIES (ANALYSIS OF THE SUPPLY SIDE)

3.1 Available domestic cooling technologies on the Rwandan market

This section provides key findings on suppliers of ACs and refrigerators in the Rwandan market. The information is aimed to help inform recommendations on policies and financial mechanisms to increase the supply of energy-efficient products on the market. The study took into consideration information obtained from the household survey and suppliers through interviews and questionnaires.

Table 12: Main features and Characteristics refrigerators in Rwandan market

Description	Variables	Frequency	Percentage %
Volume (litres) or Capacity	50-100	1	3.8
	101-200	6	23.1
	201-300	5	19.2
	301-400	1	3.8
	401-500	13	50.0
Energy Efficiency (Btu/hr or kW)	150-200kWh/annum	3	11.5
	201-250kWh/annum	4	15.4
	301-350kWh/annum	8	30.8
	351-400kW/annum	3	11.5
	401-500kWh/annum	8	30.8
Refrigerant Gas	R600a	20	76.9
	R134a	6	23.1
Energy Label type, if any	A	7	26.9
	A+	16	61.5
Typical lifetime of an AC system (in years)	6-10 years	4	15.4
	11-15 years	5	19.2
	16-20 years	14	53.8
	21-25 years	3	11.5
Typical lifetime of a refrigerator (in years)	6-10 years	7	26.9
	11-15 years	12	46.2
	16-20 years	6	23.1

3.1.1 Volume (litres) or Capacity

50 per cent of the refrigerators sold in Rwandan market have high capacity of about 400-500 litres. They are mainly top freezer refrigerators, which are the best-selling type of refrigerators on the Rwandan market.

3.1.2 Energy Efficiency (Btu/hr or kW)

On the issue of energy efficiency, the study indicates that there are varied types of refrigerators with different levels of energy efficiency consumption on the market. The study estimates that 30.8 per cent of the total refrigerators consume between 301-350kWh/annum and 401-500kWh/annum. This translates to about 0.8-0.9 kWh and 1.1-1.5kWh per day. This is aligned with responses from the majority of households who stated spending about 0-3.5 kW per day.

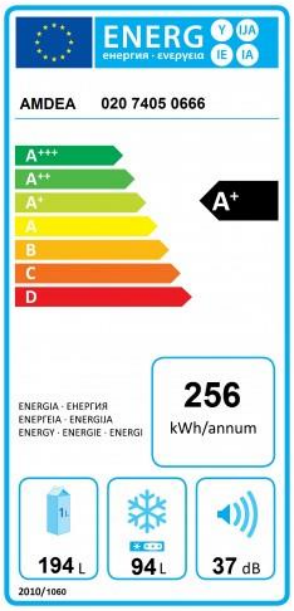
3.1.3 Refrigerant Gas

It was also noted that more than 71 per cent of refrigerators sold in Rwanda uses R600a refrigerant gas. R600a, also known as CARE ® 10, is refrigerant grade Isobutane, a natural, or "not in kind" refrigerant suitable for use in a range of refrigeration appliances. The use of R600a is increasing due to its low environmental impact and excellent thermodynamic performance and it is now the refrigerant gas of choice in domestic and small commercial refrigerators. It is non-toxic with zero ODP (Ozone Depletion Potential) and very low GWP (Global Warming Potential). R600a is a flammable gas and has low Global Warming Potential (GWP) and Ozone Depletion Potential (ODP) comparing to high GWP of R134a. Also, refrigeration cycle working with R600a, producing the same temperature by having a lower pressure in condenser, has a higher efficiency.

3.1.4 Energy Label type, if any

Energy ratings for refrigerators on the Rwandan market vary extensively. Energy Rating Label shows consumers how much energy a refrigerator or freezer uses per year and displays a star rating that allows a consumer to compare its efficiency with that of refrigerators or freezers of the same size and type. Some of the common labels found in refrigerators in Rwanda are indicated below;

Image 2: Energy Efficiency labelling on refrigerators



We noticed that over 61 per cent of the refrigerators use different energy ratings, while most of the refrigerators fall into the energy consumption rating “A+”. In comparison, 22.1 per cent of household respondents stated that their refrigerators are rated “A+”.

3.1.5 Typical lifetime of cooling appliances

The study indicated that the typical lifetime of an AC system is approximately 16-20 years as indicated by the majority of suppliers (53.8 per cent). For refrigerators, it ranges between 11-15 years, indicated by a majority of 46.2 per cent.

3.1.6 Types of refrigerators in each visited shop

The study indicates that the most popular types of refrigerators from visited shops are top-freezer refrigerators, mini-fridge, and commercial chest freezer. The least common types of refrigerators in most of the visited shops are French Door Refrigerator, Counter-Depth Refrigerator, and Side-by-Side Refrigerator, as shown in the table below.

Table 13: Types of refrigerators in each visited shop

Types of refrigerators	No. of the suppliers	Mean	Std. Deviation
Top Freezer Refrigerator	26	1	0
Side-by-Side Refrigerator	26	1.6538	0.48516
Bottom Freezer Refrigerator	26	1.4231	0.50383
French Door Refrigerator	26	1.5769	0.50383
Counter-Depth Refrigerator	26	1.5	0.5099
Mini Fridge	26	1.1154	0.32581
Commercial Refrigerator	26	1.1538	0.36795

3.1.7 Refrigerator brands in each visited shop

The most common refrigerator brands on the Rwandan market are Super General, LG, Mika and Samsung, as shown in the table below.

Table 14: Occurrence of refrigerator brand in each visited shop

Brand	No. of the suppliers	Mean	Std. Deviation
Konka Brand	26	1.8077	0.40192
LG Brand	26	1.3077	0.47068
Samsung Brand	26	1.5	0.5099
Super General	26	1.2308	0.42967
Sanny Brand	26	1.6538	0.48516
Mika Brand	26	1.4615	0.50839
Glamstar Brand	26	1.6154	0.49614
Von Brand	26	1.6154	0.49614
Skyworth Brand	26	1.8077	0.40192
Panasonic Brand	26	1.5769	0.50383
Media Brand	26	1.6154	0.49614
Sharp Brand	26	1.6538	0.48516

3.2 Market supply of ACs and refrigerators in Rwanda

Table 15: Characteristics of suppliers

Description	Variables	Frequency	Percentage (%)
Types of appliances supplied	Refrigerator	17	65.4
	Both	9	34.6
Number of employees	1-10	16	61.5
	11-20	4	15.4
	Nonresponse	6	23.1
Whether the suppliers import appliances directly	Yes	15	57.7
	No	11	42.3
Country of Origin	China	6	23.1
	Indonesia	7	26.9
	Korea	5	19.2
	Thailand	5	19.2
	India	3	11.5

3.2.1 Types of appliances supplied

Majority of respondents (65.4 per cent) only sell refrigerators, while 34.5 per cent sell both refrigerators and air conditioners. Suppliers like LG (Hot-point) and Konka only sell their own

brand of refrigerators and air conditioners, while many retailers share their stores with other traders who sell a wider range of electronic products.

3.2.2 Supply chain

Most of the products sold in Rwanda are imported. About 58 per cent of respondents, mainly brand representatives in Rwanda, import their products in large quantity. The rest (42 per cent) are mainly retailers who get their products from importers and sell them locally with a small margin. Most of the appliances are imported from Asian countries like Thailand, Korea, and China. For instance, Samsung, a Korean company, manufactures refrigerators in Korea, Malaysia, India, China, Mexico, USA, Poland, and Russia. For greater market coverage, they constantly introduce new technologies and developments in refrigerators.

Regarding the distribution of refrigerators in Rwanda, the study reveals that the majority of suppliers sell their appliances to people living within Kigali city (57.7 per cent of respondents). Indeed, nearly all the main distributors have their main branches in Kigali city. It is only Sky Worth, which has its head office outside Kigali in Gisenyi, in West province. 42.3 per cent of respondents sell refrigerators in the whole county, but principally in the major cities in Rwanda.

3.3 Financing, payment models and warranty

Table 16: Financing and payment model for suppliers

Description	Variables	Frequency	Percentage %
Clients' favourite method of payment	Cash	17	65.4
	Credits	7	26.9
	Leasing	1	3.8
Average tenor of the credit	1-3 months	5	19.2
	4-6 months	4	15.4
	7-12 months	3	11.5
	Nonresponse	14	53.8
Origin of financing	A bank	18	69.2
	A microfinance institution	3	11.5
	Other (Saving and Credit Cooperatives Organizations (SACCOs)	4	15.4
Product warranty	Yes	26	100.0
	No	0	0
Warranty period	1-3 years	10	38.5
	3-6 years	9	34.6
	7-10 years	7	26.9
Regions or cities with high supply of appliances	The whole country	11	42.3
	Kigali City	15	57.7

The majority of suppliers (69.2 per cent) obtain financing from commercial banks including loans, while 11.5 per cent work with microfinance institution and 11.5 per cent raise financing through Savings and Credit Cooperatives

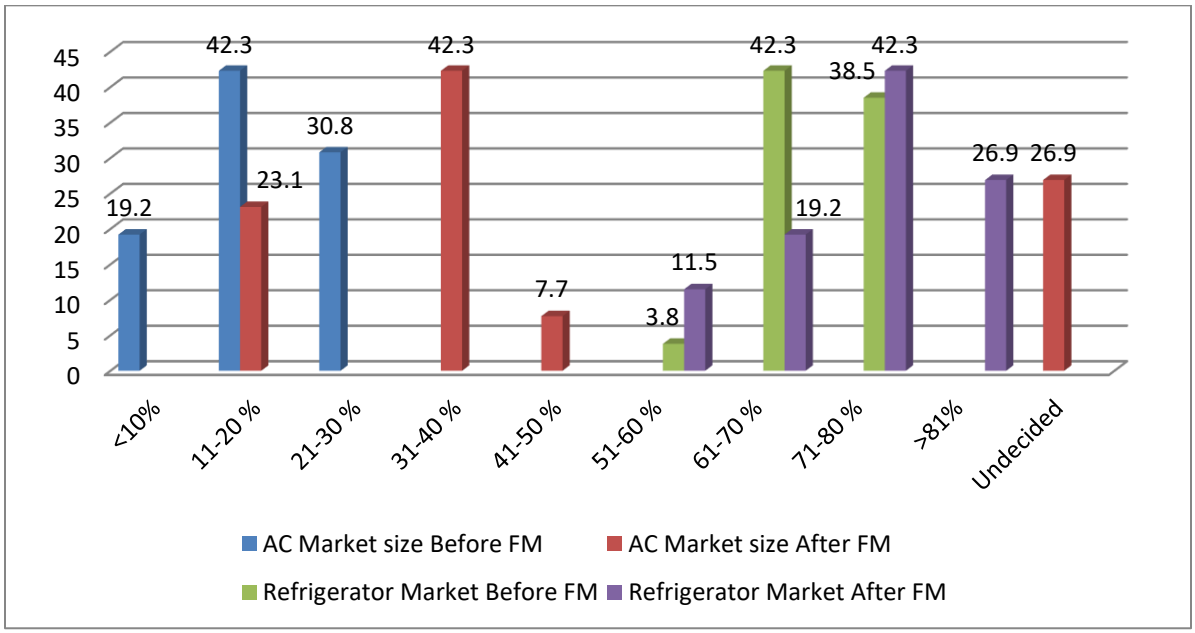
The majority of suppliers' clients (either public, commercial or residential) seeking to purchase ACs or refrigerators usually pay upfront, while about 27 per cent purchase appliances on credit. Financing and repayment terms offered by suppliers generally depend on their market penetration strategies. While many suppliers including selling outlets such as supermarkets allow their clients to purchase appliances on credit with a grace period of 3 month to clear the payment. Some suppliers like Konka provide a credit grace period of 13 months to their clients.

Besides financing, all suppliers provide a product warranty to their clients. The typical period of warranty declared by respondents ranges between 1 to 3 years. This is a reasonable period, which provides clients with the confidence and trust that the appliances supplied are of good quality.

3.4 Estimated market size of the appliances by suppliers in Rwanda

This section seeks to assess the penetration rate of refrigerators and ACs for households and light commercial clients in Rwanda. Penetration rate is the percentage of the target market that a supplier can reach with a product, service or brand in a given period of time, say in a year.

Figure 9: Current estimated AC and refrigerator market before and after financial mechanism



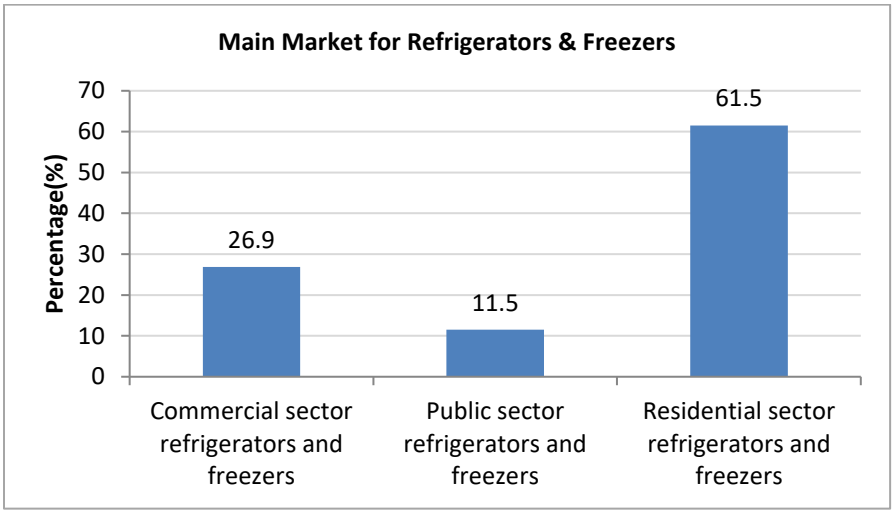
3.4.1 Current estimated AC market and future market estimates after financial mechanism

The study reveals that the majority of suppliers (42.3 per cent) indicated that the current estimated market penetration of ACs in Rwanda ranges between 11-20 per cent penetration rates. In general, the study reveals that the AC market in Rwanda is less than 30 per cent. However, 42.3 per cent of suppliers were optimistic that with the introduction of a new financial mechanism, this trend may shift to about 30-40 per cent. It implies that the majority of suppliers believe that it will boost the sales of their products.

3.4.2 Current estimated refrigerator market and future market estimates after financial mechanism

42.3 per cent of the respondents estimate that the current market penetration of refrigerator in Rwanda ranges between 61-70 per cent but believe with the introduction of a financial mechanism market penetration can increase to about 70-80 per cent.

Figure 10: Market segments for refrigerators and freezers per sector

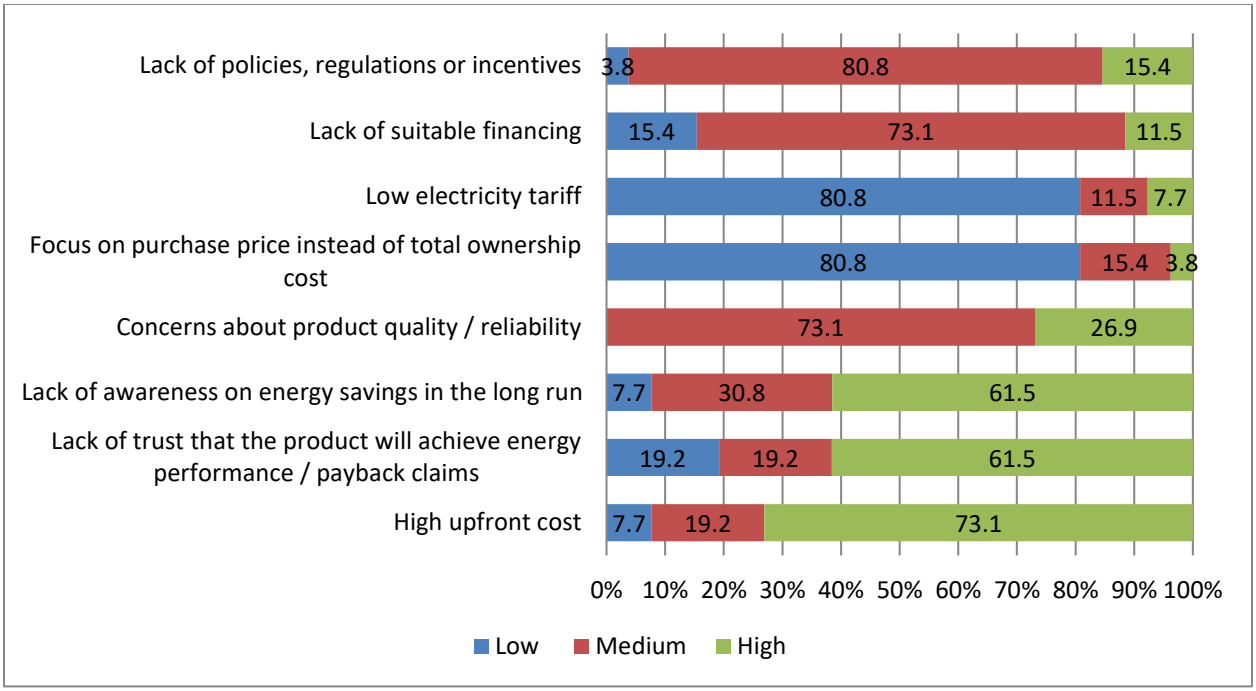


3.4.3 Market segments for refrigerators and freezers per sector in Rwanda

The study indicates that 61.5 per cent of refrigerators and freezers in Rwanda are sold to residential clients, while 26.9 per cent are sold to commercial clients and 11.5 per cent are sold to the public sector. In general, the majority of consumers of these appliances are individuals in the residential sector.

3.5 Perceptions and barriers

Figure 11: Factors affecting the sales of energy-efficient refrigerators to clients:



3.5.1 Factors affecting the sales of energy-efficient refrigerators to clients

First factor that affects the ability of suppliers to sell more energy-efficient refrigerators in Rwanda is their high upfront costs compared to lower efficiency models. There is a need to come up with a financial mechanism, which will allow the clients, commercial, public or households, to purchase the appliance with no upfront payment.

Second factor is the lack of awareness on energy saving appliances by clients. Many people still believe that refrigerators consume a lot of power, not knowing that there are some new energy efficient refrigerators on the market. Third factor is the lack of trust that the product will achieve the promised energy efficiency. There is thus also a need to conduct awareness campaigns to sensitize the public on energy-efficiency standards and labelling.

IV. FINANCIAL INSTITUTIONS AND FINANCIAL INSTRUMENTS

4.1 Financial Institutions

Recently, the Central Bank of Rwanda directed all commercial banks to increase the minimal core capital for commercial banks fourfold or 300 per cent from Rwf5 billion to Rwf20 billion. The move was partly prompted by the growing financing needs of the economy as well as the need to increase financial stability and protect public deposits. This directive has influenced the consolidation of the sector with mergers and acquisitions of relatively small banks. Small banks have up to five years to either raise the required capital or merge or face the risk of closure.

Table 17: Summary Profile of surveyed commercial banks in Rwanda

Institution	Founded	Operations	Headquarters	Employees
Equity Bank	2011	Regional	Nairobi, Kenya	383+
I&M Bank	1974	Regional	Nairobi, Kenya	300+ (2015)
Bank of Africa	2003	Rwanda	Kigali, Rwanda	100+ (2014)
Bank of Kigali	1966	Rwanda & Kenya	Kigali, Rwanda	1,200+ (2017)
KCB Bank Rwanda	2008	Regional	Nairobi, Kenya	220+
Access Bank	1995	Regional	Kigali, Rwanda	150 (2011)
Cogebank	1999	Rwanda	Kigali, Rwanda	400+ (2015)
Urwego Bank	2007	Rwanda	Kigali, Rwanda	325+
GTBank formally Fina Bank Rwanda	2004	Rwanda	Kigali, Rwanda	180+

Rwanda's banking system is highly concentrated, but increasingly competitive as foreign banks increasingly look to enter the country. Around 76 per cent of all bank assets are held by five of the largest commercial banks (Bank of Kigali, BPR Atlas Mara, I&M Bank, COGEBANQUE, and Equity Bank). The largest, partially state-owned Bank of Kigali (BoK), holds more than 30 per cent of all assets.

As of July 2018, 16 banks were registered with the National Bank of Rwandan (BNR): 11 commercial banks, three microfinance institutions, one development bank (BRD), and one cooperative bank. There are 439 Savings Credit and Co-operatives (SACCOs), and 20 limited liability microfinance institutions whose difference is based in scale of business and target customers[6]. The scale of operations of commercial banks is not limited to households whereas on the other hand, MFIs' and SACCOs disburse loans of small amounts to poor households to invest in their small business or for personal use. The basic purpose of MFIs' is to enable financial inclusion.

[6] https://www.bnr.rw/index.php?id=174.

4.1.1 Commercial banks characteristics

There are currently 11 commercial banks in Rwanda, besides a number of microfinance institutions and rural savings and credit cooperatives. The three largest commercial banks in descending order of market share are: Bank of Kigali, Banque Populaire du Rwanda (BPR) Atlas Mara (which is about to merge with Equity Bank), and I&M Bank. Other foreign banks present in Rwanda are includes Ecobank, GT Bank, Equity Bank, Kenya Commercial Bank and the Commercial Bank of Africa (CBA).

According to the study, the majority of respondents provide commercial services to clients from all sectors, including retail, SMEs or even micro clients. Only few banks declared specialising either in retail, or with SMEs and micro clients. This study used the description borrowed from Small and Medium Enterprises (SMEs) Development Policy to classify the types of clients to find out the average number of clients served by commercial banks per day, as shown in the table below.

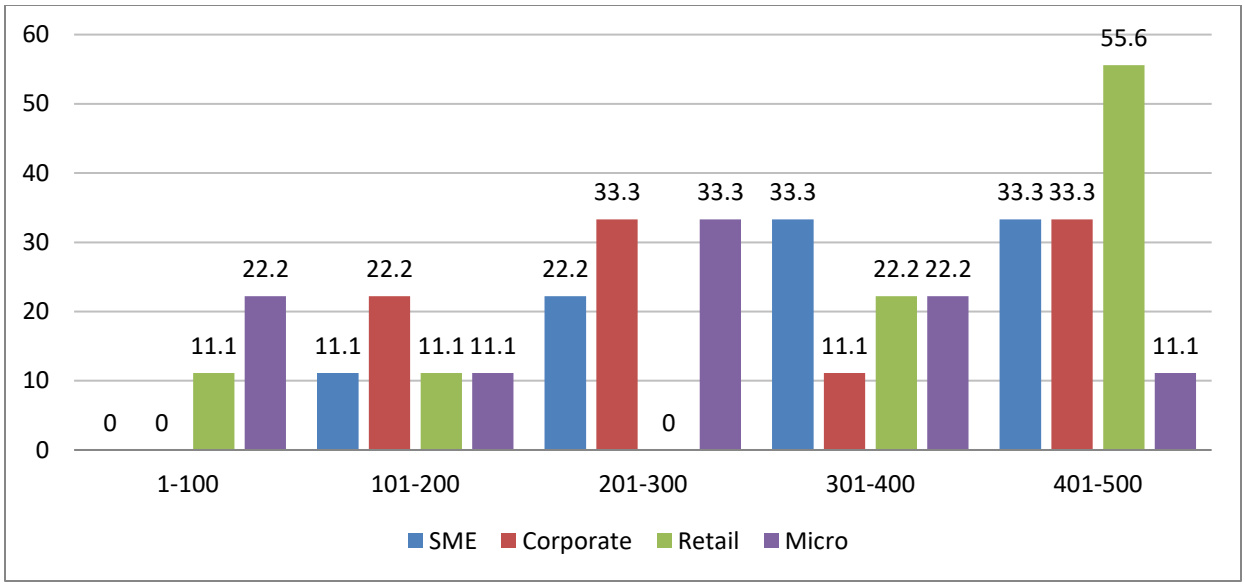
Table 18: Classification of commercial bank Clients in Rwanda

Size of the Enterprise	Net capital investments (Million Rwf)	Annual Turnover (Million Rwf)	Number of Employees
Micro Enterprises/Retail	Less than 0.5	Less than 0.3	1 to 3
Small Enterprises	0.5 to 15	0.3 to 12	4 to 30
Medium Enterprises	15 to 75	12 to 50	31 to 100
Corporate Enterprises	More than 75	More than 50	More than 100

Source: Small and Medium Enterprises (SMEs) Development Policy 2010

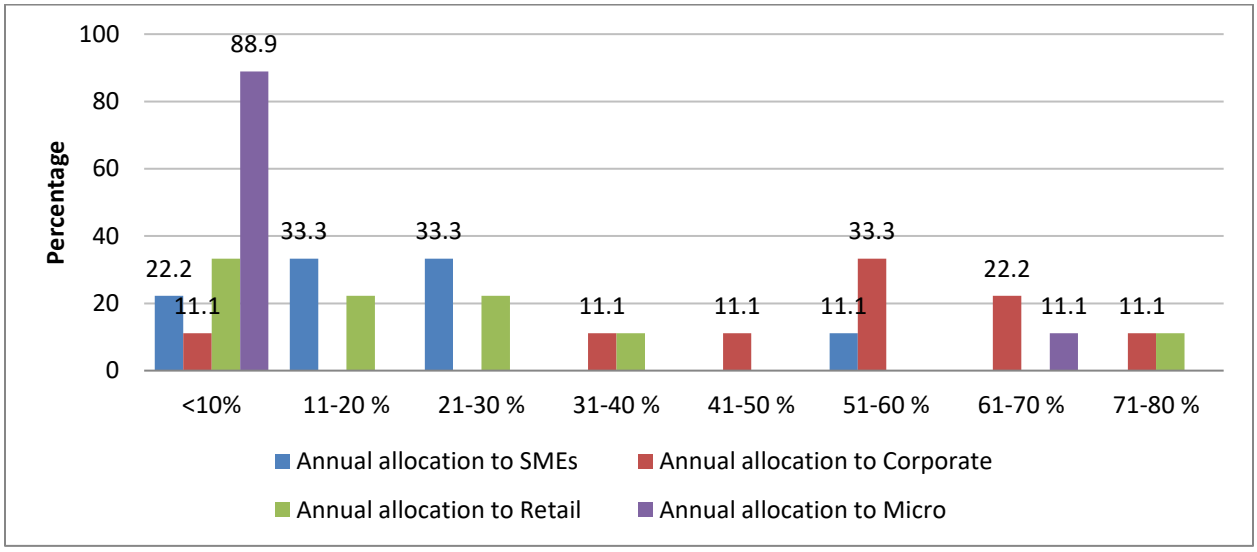
Most of the respondents declared serving an average of 401-500 clients per day, the majority of them being retail clients (55.6 per cent), as indicated in the figure below. Commercial banks consider retail clients as growth markets.

Figure 12: Average number of clients served by commercial banks per day in Rwanda



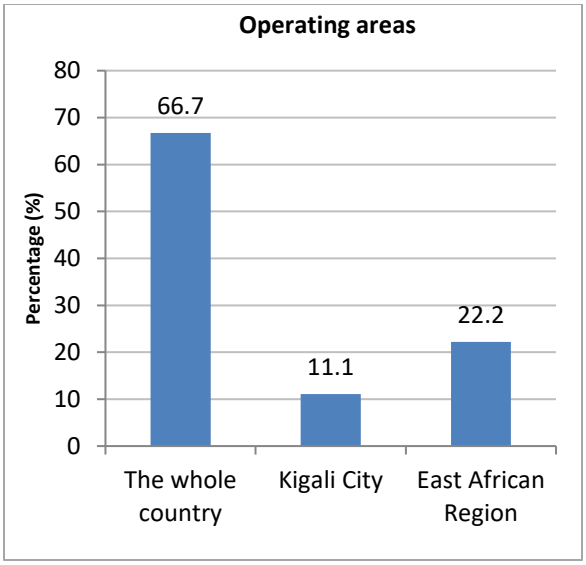
The study reveals that many commercial banks in Rwanda allocate more than 50 per cent of their annual budget to corporate clients, while less than 30 per cent of the annual budget is set aside for retail clients, SMEs and micro clients, as shown in the figure below.

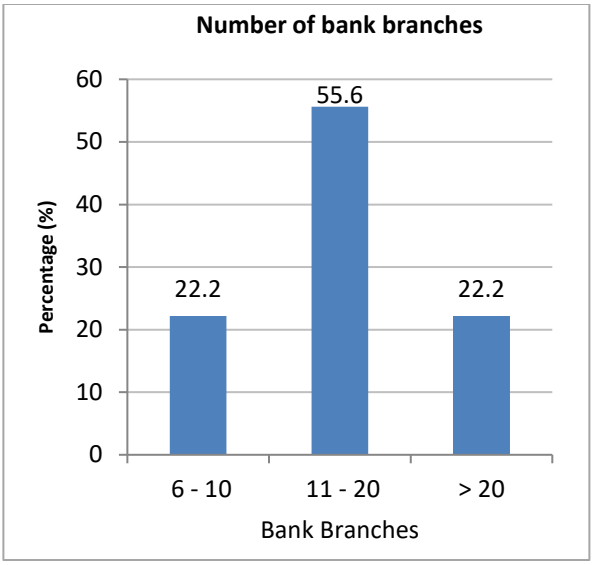
Figure 13: Annual credit allocation per sector



It was revealed that many commercial banks in Rwanda operate solely in Rwanda as indicated by 66.7 per cent of the respondents, as indicated in the figure below. Nonetheless, there are some regional financial institutions like Equity bank and KCB Bank, which operate in several countries like Kenya, Uganda, Rwanda, Congo and South Sudan. Commercial banks are present in all the major towns and introduced innovative financial services such as mobile banking and agency banking to clients.

Figure 14: Operating areas and average number of bank branches



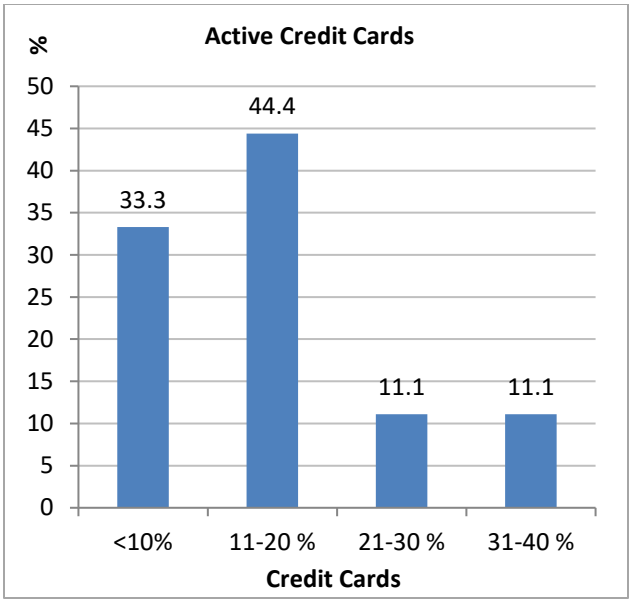


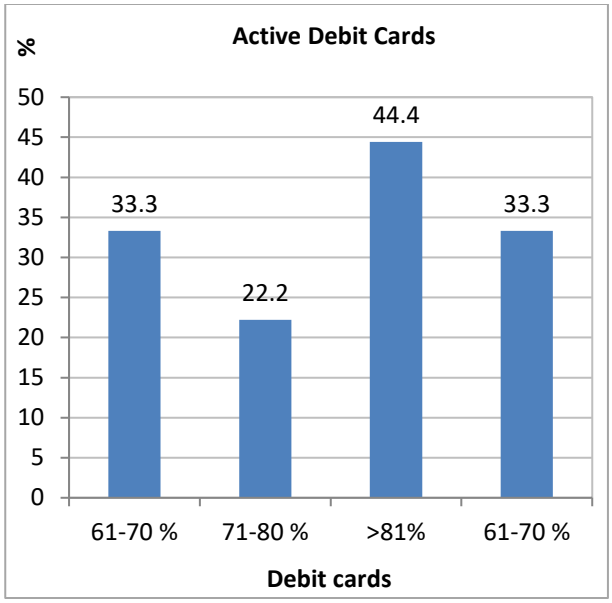
4.1.2 Issuance of credit cards in Rwanda

The study indicates that the number of active credit cards in Rwanda is less than 40 per cent whereas the number of debit cards is more than 60 per cent, as shown in the figure below. Credit cards are not used extensively, except in major hotels, grocery stores, and larger restaurants that cater to tourists. Nevertheless, the number of credit cards issued domestically in Rwanda increased from 516 in 2011 to 3,638 in 2018, while the number of debit cards issued in the country has grown more than six-fold since 2011, but remains relatively quite low at 883,755. In December 2011, Visa International opened an office in Rwanda and announced a partnership with the central bank through which the company is working to expand electronic payment services throughout Rwanda. While the use of credit cards is becoming more popular, Rwanda, especially outside of Kigali, remains primarily a cash-based or mobile cash money-based economy[7].

Figure 15: Number of active debit and credit cards in commercial banks in Rwanda

[7] Rwanda Banking System. https://www.export.gov/article?id=Rwanda-Banking-System (Accessed 7th Novemer 2018)





4.1.3 Key barriers and opportunities with commercial banks

The study reveals that none of the responding commercial banks offer green credit lines yet, as indicated in the table below. However, 88.9 per cent are interested in offering green loans to their clients. In particular, the majority of respondents stated that they are interested in and comfortable with financing energy-efficient cooling appliances through such a product with a focus on refrigerators. However, more than 66.7 per cent of respondents indicated that they currently do not finance suppliers of energy efficient equipment. Respondents stated that they perceive risk in financing energy efficient equipment respectively because of late loan repayment from clients (77.8 per cent) and the inability of clients to pay loans (22.2 per cent). Nevertheless, 77.8 per cent of the respondents claim that they have an Environmental and Social Risk Management System. Finally, all respondents would like to be involved in RCOOLFI to help raise awareness or pilot a new financial mechanism.

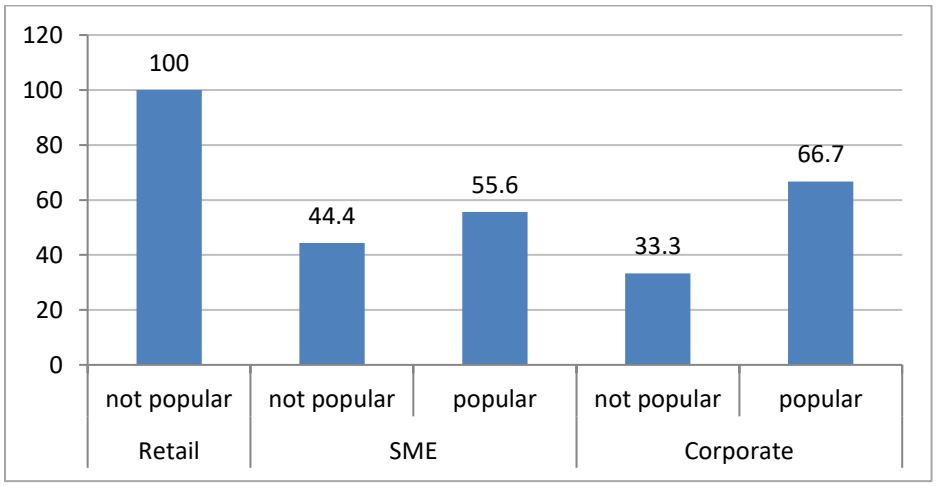
Table 19: Assessment of green credit line in Commercial banks in Rwanda

Description	Variables	Frequency	Percentage (%)
Do you have a green credit line?	No	9	100.0
If not, would you be interested in developing a green credit line?	Yes	8	88.9
	No	1	11.1
What type of product would you be the most interested in financing through such a green credit line?	Refrigerators	4	44.4
	Solar PV	1	11.1
	Both ACs and refrigerators	4	44.4
How comfortable are you financing clients' investment in energy efficient equipment?	Comfortable	9	100.0

Do you already finance suppliers of energy efficient equipment	Yes	3	33.3
	No	6	66.7
Do you perceive any risk in financing energy efficient equipment?	Yes	6	66.7
	No	3	33.3
What are the key barriers to financing energy efficient equipment?	Late repayment of loans	7	77.8
	Inability to pay loans	2	22.2
Do you have an Environmental and Social Risk Management System?	Yes	7	77.8
	No	2	22.2
How would you like to be involved in the RCOOLFI residential project?	Help raise awareness	5	55.6
	Help pilot new financial mechanisms	4	44.4

However, risk perception and financial appetite is inversely proportional to client type. Indeed, the study indicates that all respondents perceive a high risk in financing retail clients directly for investment in energy efficient equipment. Commercial banks would rather finance suppliers like retailers for energy-efficient equipment because they may use their stock as collateral. Respondents perceive a low risk in financing SME clients and the lowest risk in financing corporate clients for similar investment.

Figure 16: Risk perception of financing energy efficient equipment per client type



V. POLICY FRAMEWORK, INITIATIVES AND PARTNERSHIPS

5.1 Policy Framework

The Rwanda energy sector has mission objectives for energy policy summarized as follow[8]: "(a) To make sure sufficient, reliable and affordable energy supplies are available to all the population in Rwanda, (b) To set up and promote an enabling environment for increased private sector participation in energy supply and service provision, (c) Encouraging and incentivizing more rational, efficient use of energy in public institutions, and amongst industrial and household end-users, (d) Ensuring the sustainability of energy exploration, extraction, supply, and consumption so as to prevent damage to the environment and habitats, (e) Promoting safe, efficient, and competitive production, procurement, transportation, and distribution of energy, and (f) Developing the requisite institutional, organizational, and human capacity to increase accountability, transparency, national ownership and decentralized implementation capacity for sustainable energy service delivery."

The targets of energy strategic plan can be summarized as follow[9]:

" (a) Reduction of losses in the national electrical grid and sustain energy efficiency measure of 10 per cent by the help of demand management, (b) Reduce the carbon intensity of the grid by 10 per cent by 2019 and 25 per cent by 2025, (c) To be sure 80 per cent of all households use clean, efficient, sustainable, modern, and affordable cooling and cooking energy technologies."

5.2 Initiatives

In mid-2019, the Rwanda Green Fund (FONERWA) and the Rwanda Business Development Fund (BDF), in partnership with U4E and BASE launched the 'Coolease' financial mechanism to promote the adoption of energy-efficient and climate-friendly cooling solutions for businesses in Rwanda. The Coolease scheme is one of the first of its kind in Africa and is aimed to enable suppliers and end-users of commercial air conditioning and refrigeration products to transition to the latest technology without an upfront investment. This ground-breaking financial scheme was developed through RCOOL and is in line with the Kigali Amendment to the Montreal Protocol, which requires all nations to phase down refrigerants that are potent greenhouse gases.

[8] MININFRA, 2015a
[9] MININFRA, 2015b

5.3 Partnerships

5.3.1 Development Bank of Rwanda (BRD)

Discussions were held with leading financial institutions to understand the development of the Rwandan financial market including ten commercial banks operating in Rwanda and the Development Bank of Rwanda (BRD). In 2015, BRD concluded its restructuring process to align the bank's operations and management to its new expanded and refocused mandate of a purely Development Finance Institution (DFI) following the disposal of the commercial retail banking activities to Atlas Mara. Main task of BRD is to implement government plans for development.

Discussions with BRD were both held at the executive level, and the management level of the Energy department. The Energy department is divided into three sections - Generation, Energy Efficiency, and Technical Assistance Fund. At the moment BRD is investing $185 million in the energy sector and is mobilizing an additional $638 million from other stakeholders. Energy projects require significant time and financial investments. Their long-term nature requires specialized financing terms. So far, the investment focus has been on on-grid energy generation, such as hydropower and heat to power. But now, BRD is going into off-grid energy generation with a Renewable Energy project supported by the World Bank, which is a $48.9 million fund to help the Government of Rwanda to achieve 100 per cent electrification by 2024 by driving the development of household solar home systems.

BRD executive directors at the department of Energy Financing in charge of implementing the Bank's intervention in the energy sector were happy to share their optimism on the development of a financial mechanism to increase the uptake of energy-efficient domestic and light commercial cooling equipment in Rwanda. They indicated that they are willing and ready to finance the development of such a mechanism, like the on-bill financing mechanism, as early as possible.

They indicated that they are willing to work together with the suppliers in providing them with financial loans, which will enable suppliers to purchase energy-efficient refrigerators and/or ACs. Alternatively, they can also work directly with households who wish to acquire either refrigerators or ACs from any suppliers of their choice assuming a collateral will be provided. The main requirements for BRD to allocate funding to a financial mechanism are to share credit risk and to avoid any kind of stock of equipment at any time. BRD's interest rate is weighted at 17.6 per cent as per August 2019 according to BNR, which is similar to commercial bank's rate. Through the development of green credit lines, BRD is willing to offer preferential rates for energy efficiency and participating in a financial mechanism like the on-bill financing mechanism. BRD is seeking to partner with different stakeholders to develop technical

capabilities of the different players in the sector. If the proposed financial mechanism is completed, it will become one of the main flagship projects implemented by BRD.

5.3.2 Rwanda Energy Group (REG)

Discussions were held with the director of commercial services at REG. Insightful information on its wholly owned subsidiary - the Energy Utility Corporation Limited (EUCL) and energy consumption in Rwanda were shared.

EUCL is responsible for maintaining and improving power plants, transmission and distribution networks, as well as delivery of electrical electricity at a sustainable fee. There are there categories of clients served by EUCL - residential clients who consume about 30 per cent of the total energy, non-residential clients which consume about 30 per cent of the total energy, and industries which consumes about 40 per cent of the energy produced. The total rate of electricity access and connectivity in residential sector is about 52 per cent, including about 38 per cent on-grid and 14 per cent off-grid.

Rwanda per capita electricity consumption (30 kWh) is the lowest in the East African Community (EAC), when compared to Kenya (140 kWh), Tanzania (85 kWh), and Uganda (66 kWh); where about 25 per cent of the imported petroleum products is used for electricity generation at the thermal power plants[10]. The high costs of fuel used to operate the thermal power plants have made the Government of Rwanda to subsidize domestic electricity tariffs (by about $40 million annually) to make them comparable with the regional price range of between $0.12 and $0.18.

[10] Hakizimana, J. D. K., Yoon, S. P., Kang, T. J., Kim, H. T., Jeon, Y. S., and Choi, Y. C. (2016). Potential for peat-to-power usage in Rwanda and associated implications. *Energy Strategy Rev.* 13–14, 222–235. doi: 10.1016/j.esr.2016.04.001

Table 20: Electricity tariff per customer type, EUCL 2019

Electricity Tariff (VAT Exclusive)		
RESIDENTIAL CUSTOMERS		
0–15 kWh		89 RWF/kWh
>15–50 kWh		182 RWF/kWh
> 50 kWh		189 RWF/kWh
NON RESIDENTIAL CUSTOMERS		
[0–100] kWh		189 RWF/kWh
>100 kWh		192 RWF/kWh
INDUSTRIAL CUSTOMERS		
Basis of charge		
Small industries including water treatments plants, water pumping stations and telecom towers	RWF/kWh	126
Medium Industries: (0.4 kV < V≤ 15 kV)		
Energy Charge	**RWF/kWh**	**90**
Max Demand charge (17 h 00 p.m.–23 h 00 p.m.) Peak	RWF/KVA/month	10469.55
Max Demand charge (08 h 01 a.m.–16 h 59) p.m. Shoulder	RWF/KVA/month	5588.41
Max Demand charge (23 h 01 p.m.–08 h 00) Off-Peak	RWF/KVA/month	1891.54
Customer Service charge	RWF/Customer/Month	3125

EUCL already have planned activities related to energy efficiency. EUCL set up a unit that is in charge of energy efficiency whose mandate is to carry out awareness campaign to encourage people to adopt energy-efficient products and lower their electricity consumption. Also, the unit has set out a range of initiatives which aim to improve efficiency across the entire electricity value chain, from generation, through transmission and distribution to end-user consumption.

Regarding specific clients where EUCL puts more emphasis on energy efficiency initiatives (whether in residential, commercial, or in the public sector), it is advantageous for EUCL if an extra power is saved from both residential and non-residential sectors because the extra saving can be channelled to the industrial sector where EUCL can recoup extra earning since industrial clients pay higher tariffs. This is why the energy efficiency unit principally conduct end-user efficiency initiatives to support the adoption and use of LEDs and the introduction of standards and labelling on appliances.

While seeking to know what EUCL hope to be addressed in the national policies recommendations and the financial mechanism that will be developed through RCOOL, EUCL emphasized there is a need for more detailed discussions on the model to be used, logistics of the utility, management of clients and suppliers as well as recovery process.

For instance, it was noticed that EUCL has a program of on-bill financing whereby they don't charge upfront electricity connection fee of about 56,000 Rwf ($60) to the client. Instead, they attach it on the meter such that when they load for power 50 per cent goes to the power and 50 per cent is deducted to pay connectivity fee. However, this has not been easy because many

people (about 25 per cent) have not been fully compliant. After burning the first few units, some realize that they are not able to repay the full amount. Then some clients try to avoid their obligation of repayment either by changing their location, applying for new meter, or applying as a new client. Rwanda Energy Group (REG) has always condemns such acts as it causes both revenue losses and/or fatal accidents. It is also punishable by the law N°52/2018 of 13/08/2018 modifying Law Nº21/2011 of 23/06/2011 governing electricity in Rwanda as modified to date. REG is committed to ensure affordable and reliable electricity supply while improving the service delivery. As of today, Rwanda has an installed capacity of 221.1MW and more than 1.34 million Rwandan households have access to electricity. By the year 2024, Government of Rwanda is targeting a 100 per cent access to electricity while the generation capacity will be increased up to 556 MW. These cases of default in payment of meter connectivity fees where people default on electricity to an extent that REG through its sister company EUCL are forced to disconnect and lock client's meters are issues that would need more attention if developing the on-bill financial mechanism.

Also, even though the study sampled a majority of household owners, EUCL respondent alluded that many clients are still living in rental houses in the main cities of Rwanda. This means that most of electricity meters are registered under the names of landlords. For example, someone could go to the supplier and acquires an appliance in exchange of giving out the meter number belonging to the landlord. If such person defaults and decides to relocate to another place, landlords come to complain that their meter has been disconnected instead of following up the specific person (tenant) who in most cases have already shifted to a new address. EUCL encounters 3-4 similar complains every week.

So, it is of utmost importance to address the issues of defaulting on payment, coming up with mechanisms that can be used to minimize risk of financial non-performance, debt recovery strategy for the acquired appliance, developing a financial mechanism which may limit the intervention of EUCL to disconnect power for their clients while better following up defaulting clients.

Finally, EUCL needs to understand better the value proposition of disrupting their core business of selling electricity while supporting this energy-efficiency initiative. For example, questions like how much electricity sales revenue from clients would EUCL expect to forego and how much could be recovered through savings on avoided new installed generation capacity and/or a management commission fee must be addressed.

VI. MARKET BARRIERS AND OPPORTUNITIES

Some of the barriers affecting household clients in adopting energy efficient refrigerators particularly those who already have old appliances is the high upfront cost. There is also the aspect of lack of trust that the product will achieve energy performance / payback claims as well as lack of awareness on energy savings in the long run.

Technology suppliers face the challenge of financing energy efficient cooling equipment because they lack suitable financing. There is also lack of policies, regulations or incentives that is why in Rwanda today, there several cooling appliances without standardized energy e efficient rating.

Somme of the opportunities which are there in the market is the support from the government. The government has ratified Kigali Amendment aims for the phase-down of hydrofluorocarbons (HFCs) by cutting their production and consumption. Given their zero impact on the depletion of the ozone layer, HFCs are currently used as replacements of hydrochlorofluorocarbons (HCFCs) and chlorofluorocarbons (CFCs), however they are powerful greenhouse gases. With the Kigali Amendment, the Montreal Protocol will be an even more powerful instrument against global warming. The amendment came into force on 1 January 2019, provided it has been ratified by at least 20 parties. The goal is to achieve over 80 per cent reduction in HFC consumption by 2047. Majority of the people who participated in this study were ready to provide feedback on draft policies documents, help raise awareness among consumers / public, assist with training for technicians, sales reps, or officials, participate in trials / demonstrations and also pilot new financial mechanisms

VII. CONCLUSIONS

In conclusion, the study observed there has been a steady increase of refrigerators in the residential sector since 2012 with an estimated stock of 97,512 refrigerators owned by households in Rwanda in 2019. The highest market potential for refrigerators is in Kigali city, followed by the Southern Province, the Western Province, the Eastern Province, and finally the Northern Province. Whereas the AC market at the household level in Rwanda is relatively small. It is clear that very few households in Rwanda own ACs or fans and growth trajectories appear limited outside of the small but growing demand in the commercial sector. This is due to relatively cool climatic condition, which Rwanda enjoys throughout the year considering its geographic location near rainy Congo forest.

Also, the findings indicate that the best potential residential market segments are medium-income household with about 66.3 per cent market share- and high-income households

controlling about 23.2 per cent of the market share including micro entrepreneurs from urban areas controlling about 26.9 per cent. It is therefore recommended to focus RCOOLFI on energy-efficient refrigerating appliances in the residential and light commercial sectors. Many low-income earners do not have refrigerators and ACs because it is a luxury commodity that they simply cannot afford. Although most of the refrigerators found in households are new (58.6 per cent were bought less than three years ago), there is a large number, (36 per cent) which is approximately 35,104 households who purchased their refrigerating appliances more than 4 years ago and may still use potent gas. The outlets selling the highest quantities of these appliances are supermarkets and brand representative shops.

The study reveals that about 97.7 per cent of the household respondents own a bank account. This shows that there is high financial inclusion among the medium-income and the high-income earners in Rwanda. 83.3 per cent of the respondents have bank accounts in commercial banks while 11.9 per cent bank with microfinance institutions. 90.1 per cent of the households use mobile banking meaning that it is more convenient to involve commercial banks and use mobile customer interface for effective and efficient financial transactions when developing a target financial mechanism for RCOOLFI.

Nonetheless the study revealed there are some financial and technical barriers which would need to be addressed to accelerate the transformation of the market towards energy-efficient cooling equipment. For the end-users, they pay high upfront cost, there is lack of trust that the product will achieve energy performance / payback claims and also lack of awareness on energy savings in the long run. For financial institutions, increasing green financing would require to minimise risk of financial non-performance, resolving the question of defaulting on payment, and clarifying a debt recovery strategy for the acquired energy-efficient cooling appliances. For the technology providers, some of the issues in questions were about how to minimize defaulting and the issue of replacement of new refrigerators. These findings help to identify the significant life-cycle cost of ownership savings that can be realized by purchasing products that are more expensive to purchase but cost far less to operate due to lower electricity bills.

Therefore, it is conclusive that the provision of energy-efficient and climate-friendly refrigerators and ACs is feasible in Rwanda, as supported by market opportunities, preferences from households, the existence of policy and institutional framework, as well as opportunities for partnership and collaboration among various stakeholders. It is therefore recommended that used cooling appliances be removed from the market as part of any mechanism to target the highest potential market segments and address barriers in order to introduce energy-efficient and climate-friendly cooling appliances into the Rwandan market.

APPENDIXES

Sample frame

Location on each province based on the size of the towns	Description	Number of households (2012 Census)	Sample size
Kigali	**Suppliers and retailers** (Danmar/DAIKIN, Kigali Technic Constraction, Sky Worth, SHARP, Vision Technology ltd, HiFi Traiding Services, YOKI IT Services ltd, Bosch Rwanda, Saltel, MIKA-Town, KONKA Market, GLAMSTAR, Link One Company ltd, RM Innovation Electronics, Rish Impex Rwanda ltd, Hot Point/ LG UTEXRWA, X-R Trading ltd, ANYNEY TRADING, MAJASIN Faruki Trading, LG Remera-Kisimenti, Fiardee (Shopper-Kisimenti), Alrmas Shop, Cold Air, Novitas Tech ltd, Samsung (Akagera), Centre Milti Techiniques, Sony World Kigali, KONKA HQ, SHOPPERS STOP, Bricotech ltd and AirWell)	31	8
	Financial institutions which include commercial banks such as Bank of Kigali, I&M Bank (Rwanda), Compagnie Générale de Banque (Cogebanque), Kenya Commercial Bank, Ecobank Rwanda, Atlas Mara Bank, Commercial Bank of Africa (Rwanda), Equity Bank, and Fina Bank. Microfinance banks such as Urwego Opportunity Bank Other key financial institutions will include Development Bank of Rwanda (BRD) and cooperative banks such as Zigama CSS.	10	10
	Other stakeholders (Blarilwa manufacturing company, Skol manufacturing company, RURA, RRA, RSB.	5	5
	Energy Utility Corporation Limited (EUCL)	1	1
	Households (Gasabo district (Nyarutarama/Kibagabaga), Kicyukiro district (Niboyi/Kagarama) and Nyarugenge district	137,146 77,238	75 75

	Kiyovu/Rebero)	72,280	75
Huye-Southern province	High- and medium-income households	77,915	50
Musanze-Northern province	High- and medium-income households	84,756	50
Rubavu-Western province	High- and medium-income households	88,849	50
Kayonza-Eastern province	High- and medium-income households	80,517	50
		$618,748/1+618,748(0.05)^2$	**400**

APPENDICES I: QUESTIONNAIRES

Questionnaire for Households

Responses to this questionnaire are of critical importance to properly understand the market for refrigerators and air conditioners in the country. The results will be used by UN Environment to help inform recommendations on policies, programs and innovative financial mechanisms to increase adoption of energy-efficient products. UN Environment will treat questionnaire responses as business-sensitive information. The findings will be aggregated across the pool of organisations that participate to avoid attribution to any particular entity.

Point of Contact Name	Title	Email	Phone	Address/Rwanda POSTGPS	Profession
				Urban { } Rural { } *District Name*	

General Information on household

Type of Family	# of family members	Household status	Average revenue/month (Rwf)	House size (m^2)/# of rooms	# of Floors	Do you own the housing where you live?	How often have you changed addresses in the last 5 years?
Nuclear family { } *Single parent { }* *Extended family { }* *Polygamous family { }* *Childless family { }*		*Low income { }* *Medium income { }* *High income { }*	*<100,000 { }* *100,00-400,000 { }* *400,000-600,000 { }* *600,000-1,000,000 { }* *>1,000,000 { }*			*Yes { } No { }*	

General Information on electricity consumption

Name of electricity provider	Owned household appliances	Type of electricity meter	Average monthly electricity consumption (kWh)	Preferred payment method for your electricity bills

EUCL { } *Others*	*Refrigerator { }* *Air conditioner { }* *Other* { } please specify:	*Prepaid meter { }* *Smart meter { }* *Property shared meter { }* *Other* { } please specify:	*<20* kwh *{ }* *20-50 kWh { }* *60-90 kWh { }* *100-130 kWh { }* *>130 kWh { }*	*Cash { }* *Bank payment { }* *Credit card { }* *Mobile payment { }* *Other*

General Information on household finance

Do you own a bank account? If so, what is the name of your financial institution/bank?	*Yes { } No { }* *If yes which type of financial institution:* *Commercial banks { } Microfinance institutions, { } Leasing companies { } Other* { } *please specify:*
What type of bank account?	*Current account { } Saving account { } Fixed account { }*
Have you ever taken loans from your bank?	*Yes { } No { }*
If yes, what was the period (tenor) of the loan?	*0- 1 year { }* *1- 3 years { }* *3- 6 years { }* *6- 10 years { }* *> 10 years { }*
Do you own a credit card?	*Yes { } No { }*
Do you use mobile banking solutions?	*Yes { } No { }*
When was the last time you purchased an AC system? (in years)	*___ years*
When was the last time you purchased a refrigerator? (in years)	*___ years*
Where do you buy your AC or refrigerator from?	*Department store { } Supermarket { } Specialized appliances shop { } Online shop { }* *Informal market or street { } Second-hand from someone else { } Auctioneers { }* *Other* { } *please specify :*
How did you finance your AC or refrigerator?	*Credit from bank { } Leasing { } Own capital { }* *If it is own capital, did you paid using* *Cash { } Hire purchase { } Credit card { } Bank payment { } Mobile payment { }*
Do you use mainly fans, mainly ACs, or both?	*Mainly/only fans { } Mainly/only AC { } both { }*
Do you prefer to own the AC equipment or you would lease if possible? Please explain with detail	

Part A: Air Conditioners

1. Operation profile

During which months is the AC used	Daily hours of use - high demand months (when the offices/rooms are occupied)	Daily hours of use - low demand months (when the offices/rooms are occupied)
	0-3 hours { } *3-6 hours { }* *6-10 hours { }* *> 10 hours { }*	*0-3 hours { }* *3-6 hours { }* *6-10 hours { }* *> 10 hours { }*

2. Product Characteristics (add rows if necessary):

Type(s) of Air Conditioner and fans	# units in the house	Brand and Model / Series Note: add rows if needed	Cooling Capacity (kW) cooling capacity per unit	Energy Efficiency	Compressor	Refrigerant Gas (R-xxx)
Fan { } Window AC { } Ductless wall-mounted mini-split AC { } Standing unit { } Multi-split AC { } A Packaged Terminal AC { } Ducted types (central AC { }			0-3.5 kW { } 3.6-7.0 kW { } 7.1-12.5 kW { } 12.6-17.6 kW { }	EER { } SEER { } COP { } Others { } please specify	Variable { } Fixed { }	CFCs { } HCFCs { } HFCs { } Natural Refrigerants { }

Energy Label type, if any (e.g. how many energy stars)	Purchase Origin	Age of unit (years)	How much did the system cost (Rwf)	Product payback period (years)	Did you buy your system new or used?
0-2 stars { } 3-4 stars { } 5-7 starts { } 8-10 starts { }	Local supplier { } Importer based { } Overseas { } Other { } please specify:	0-1 years { } 1-3 years { } 3-6 years { } 6-10 years { } > 10 years { }	0 -100,000 { } 100,00-400,000 { } 400,000-600,000 { } 600,000-1,000,000 { } >1,000,000 { }	0-1 years { } 1-3 years { } 3-6 years { } 6-10 years { } > 10 years { }	Used { } New { }

CFCs – Chlorofluorocarbons
HCFCs – Hydro chlorofluorocarbons
HFCs – Hydro fluorocarbons

3. *Operation and Maintenance:*

Yearly expense on maintenance (local currency)	**Average monthly electricity payment (local currency)**	**Proportion of electricity expense that is from air conditioner use** (0-100 per cent)

4. *How important is each of the following points when you decide to purchase an AC?*

Factors	**None**	**Low**	**Medium**	**High**
Price of the equipment				
Warranty				
Look/Design/color				
Functional/Practical				
Energy consumption				
Access to financing				
Capacity / size				
Brand				
Quality				
Recommendation from people you know				
Availability of transport, installation and maintenance services				
Other (please specify)				

Part B: Refrigeration

6. *Product Characteristics (add rows if necessary):*

Type of Refrigerator	**# units in the house**	**Brand and Model / Series** Note: add rows if needed	**Volume Capacity** (Btu/hr or kW)	**Energy Efficiency**	**Refrigerant Gas** (R-xxx)
Top Freezer Refrigerator { } Side-by-Side Refrigerator { } Bottom Freezer Refrigerator { } French Door Refrigerator { } Counter-Depth Refrigerator { } Mini Fridge { } Commercial Refrigerator { }			0-3.5 kW { } 3.6-7.0 kW { } 7.1-12.5 kW { } 12.6-17.6 kW { }	EER { } SEER { } COP { } Others{ } please specify:	CFCs { } HCFCs { } HFCs { } Natural Refrigerants { }

Energy Label type, if any (e.g. how many energy stars)	**Purchase Origin**	**Age of unit** (years)	**How much did the system cost** (Rwf)	**Product payback period** (years)	**Did you buy your system new or used?**
	Local supplier { } Importer based { } Overseas { } Other { } please specify :	0-1 years { } 1-3 years { } 3-6 years { } 6-10 years { } > 10 years { }	0-100,000 { } 100,00-400,000 { } 400,000-600,000 { } 600,000-1,000,000 { } >1,000,000 { }	0-1 years { } 1-3 years { } 3-6 years { } 6-10 years { } > 10 years { }	Used { } New { }

7. *Operation and Maintenance:*

Yearly expense on maintenance, if any (local currency)	**Average monthly electricity payment (local currency)**	**Proportion of electricity expense that is from refrigeration use** (0-100 per cent)

8. *How important is each of the following points when you decide to purchase a refrigerator?*

Factors	None	Low	Medium	High
Price of the equipment				
warranty				
Look/Design/color				
Functional/Practical				
Energy consumption				
Access to financing				
Capacity / size				
Brand				
Quality				
Recommendation from people you know				
Availability of transport, installation and maintenance services				
Other (please specify)				

APPENDIX II: Questionnaire for Suppliers (HVAC Companies, Retailers)

Responses to this questionnaire are of critical importance to properly understand the market for refrigerators and air conditioners in the country. The results will be used by UN Environment to help inform recommendations on policies and programs to increase adoption of energy-efficient products. UN Environment will treat questionnaire responses as business-sensitive information. The findings will be aggregated across the pool of organisations that participate to avoid attribution to any particular entity.

Company	Where is your company located? *(GPS, name of place)*	Point of Contact Name	Title	Email	Phone

	Company's Profile and market opportunity	
1	Do you supply air conditioners, refrigerator, or both?	AC { } Refrigerator { } Both { }
2	Which other products do you sell?	TV sets { } Mobile phones { } Microwaves { } Water dispensers { } Radios { } Others, please specify
3	How many employees do you have?	1-10 { } 11-20 { } 21-30 { } Other, please specify
4	Do you import directly?	Yes { } No { }
5	Do you provide financing for your clients?	Yes { } No { }
5a	If yes, What is the tenor and interest rate for this financing you offer?	____ months (if years, still express in number of months) ____ per cent
6	How do your clients usually finance the purchase of your products? (i.e. upfront payments, credits, leasing,)	Own capital { } Credits { } Leasing { } Hire purchase { } Other { } please specify:
6a	**If applicable,** what is the average tenor of the credit?	1-3 months { } 4-6 months { } 7-12 months { } 13-24 months { } 25-48 months { } >48 months { }
6b	And what are the main financial sources?	The technology supplier { } A bank { } A microfinance institution { } Other { }, please specify:

7	Who are the financial institutions that your company is working with?	MFIs { } Commercial Banks { } Other { }, please specify:
8	Do you provide warranty on your products and for how long?	Yes { } No { } If yes, for _____ months / years
9	Which regions or cities do you supply?	[ ] the whole country [ ] Eastern Province [ ] Northern province [ ] Southern Province [ ] Kigali City [ ] Western Province
10a	Can you estimate the total AC market in Rwanda?	$ ___
10b	Can you estimate the total refrigeration market in Rwanda?	$ ___
11a	What per cent of you **AC** sales come from systems that have more than two stars? If you had a good financial mechanism, what would that percentage become?	___ per cent
11b	What per cent of your **refrigerator** sales come from systems that have more than two stars? If you had a good financial mechanism, what would that percentage become?	___ per cent
12a	What is the typical lifetime of an AC system? (in years)	_____ years
12b	What is the typical lifetime of a refrigerator? (in years)	_____ years
13a	How do you dispose the AC equipment, and how much does this cost per AC?	
13b	How do you dispose refrigerators, and how much does this cost per refrigerator?	
14	For AC, what is the annual cost of maintenance in per cent of price of product?	____ per cent

Part A: Air Conditioners

1. *Product Characteristics and Sales of the Most Common / Popular Products:*

Type of Air Conditioner	**Brand and Model / Series**	**Cooling Capacity** (Btu/hr or kW)	**Energy Efficiency** (EER, SEER, COP, etc.)	**Compressor Type** (inverter or fixed speed)	**Heat pump mode** (y/n)	**Refrigerant Gas** (R-xxx)	**Energy Label type, if any** (e.g. Energy Star, EU)	**Warranty Period** (months)	**Country of Origin**	**Quantity of units sold annually**	**Sales Price per Unit** ($)

2. *Clients' Profile:*

Client Type	**In per cent of your total sales**	**What share of the projects do you think are new buildings rather than retrofitting existing buildings? (0-100 per cent)**	**Average project size ($)**	**Expected demand growth over next 3 years. Rank: from 1 = best to 3 = lowest opportunity**	**Client's preferred method of payment**
Commercial sector					
Public sector					
Residential sector					

3. *Overall Sales and Market Share:*

Type of Air Conditioner	In per cent of all your sales to commercial sector	In per cent of all your sales to public sector	In per cent of all your sales to residential sector
Window-type AC			
Mini-split (wall-mounted, floor-standing or cassette)			
Multi-split system / Variable Refrigerant Flow			
Air-based chiller system			
Water-based chiller system			
Other (please specify)			

4. *Factors that impact your ability to sell more energy-efficient products to clients:*

Factor	Explanation of what occurs and recommended solutions to address the challenges	rank from 1-9 (1 being most relevant with 9 being the least relevant)
High upfront cost		
Lack of trust that the product will achieve energy performance / payback claims		
Lack of awareness on energy savings in the long run		
Concerns about product quality / reliability		
Focus on purchase price instead of total ownership cost		
Low electricity tariff		
Lack of suitable financing		
Lack of policies, regulations or incentives		
Other (please describe)		

5. *Ways that you might want to be involved in the Air Conditioners aspect of this project:*

Participation opportunities	Explanation of how you could potentially contribute to any of these that are of interest
Provide feedback on draft policies documents	
Help raise awareness among consumers / public	
Assist with training for technicians, sales reps, or officials	
Participate in recycling / waste management programs	
Participate in trials / demonstrations	
Pilot new financial mechanisms	
Other (please describe)	

Part B: Refrigeration

6. *Product Characteristics and Sales of the Most Common / Popular Products:*

Type of Refrigerator	Brand and Model / Series	Volume (litres) or Capacity	Energy Efficiency (kWh/yr/volume)		Refrigerant Gas (R-xxx)		Energy Label type, if any (e.g. Energy Star, EU)	Warranty Period (months)	Country of Origin	Quantity of units sold annually	Sales Price per Unit ($)

Note: add rows as needed to cover all commonly sold products

***7.** Clients' Profile:*

Client Type	In per cent of your total sales	What share of the projects do you think are new buildings rather than retrofitting existing buildings? (0-100 per cent)	Average project size ($)	Expected demand growth over next 3 years. Rank: from 1 = best to 3 = lowest opportunity	Client's preferred method of payment
Commercial sector refrigerators and freezers					
Public sector refrigerators and freezers					
Residential sector refrigerators and freezers					

***8.** Overall Sales and Market Share:*

Type of Refrigerator	Current Annual Sales Total ($)	Current Share of the National Market (per cent)	Expected Sales in 2020 ($)
Residential Refrigerators and Freezers			
Commercial Refrigerators and Freezers			
Industrial Refrigerators and Freezers			

***9.** Factors that impact your ability to sell more energy-efficient products to clients:*

Factor	Explanation of what occurs and recommended solutions to address the challenges	rank from 1-9 (1 being most relevant with 10 being the least relevant)
High upfront cost		
Lack of trust that the product will achieve energy performance / payback claims		

Lack of awareness on energy savings in the long run		
Concerns about product quality / reliability		
Focus on purchase price instead of total ownership cost		
Low electricity tariff		
Lack of suitable financing		
Lack of policies, regulations or incentives		
Other (please describe)		

10. *Ways that you might want to be involved in the Refrigerators aspect of this project:*

Participation opportunities	Explanation of how you could potentially contribute to any of these that are of interest
Provide feedback on draft policies documents	
Help raise awareness among consumers / public	
Assist with training for technicians, sales reps, or officials	
Participate in recycling / waste management programs	
Participate in trials / demonstrations	
Pilot new financial mechanisms	
Other (please describe)	

APPENDIX III: SEMI STRUCTURED INTERVIEW

Questionnaire for Financial Institutions

Responses to this questionnaire are of critical importance to properly understand the market for refrigerators and air conditioners in the country. The results will be used by UN Environment to help inform recommendations on policies, programs and innovative financial mechanisms to increase adoption of energy-efficient products and help financial institutions build a pipeline for investment in energy efficient cooling equipment. UN Environment will treat questionnaire responses as business-sensitive information. The findings will be aggregated across the pool of organizations that participate to avoid attribution to any particular entity.

Organization	Point of Contact Name	Title	Email	Phone

1. What are your main clients/sectors? [ ] SME [ ] Corporate [ ] Retail [ ] Micro [ ] Other, please specify
   a. How many clients per sector do you service?

SME	[ ] 1-100 [ ] 101-200 [ ] 201-300 [ ] 301-400 [ ] 401-500 [ ] Other, please specify …
Corporate	[ ] 1-100 [ ] 101-200 [ ] 201-300 [ ] 301-400 [ ] 401-500 [ ] Other, please specify …
Retail	[ ] 1-100 [ ] 101-200 [ ] 201-300 [ ] 301-400 [ ] 401-500 [ ] Other, please specify …
Micro	[ ] 1-100 [ ] 101-200 [ ] 201-300 [ ] 301-400 [ ] 401-500 [ ] Other, please specify …
Other …	[ ] 1-100 [ ] 101-200 [ ] 201-300 [ ] 301-400 [ ] 401-500 [ ] Other, please specify …

   b. What is your annual credit allocation per sector?

SME	[ ] please specify …
Corporate	[ ] please specify …
Retail	[ ] please specify …
Micro	[ ] please specify …
Other …	[ ] please specify …

c. Where are you active? (e.g. country, regions, cities, urban, rural, other, …)

Which regions do you supply?	[ ] the whole country
	[ ] Eastern Province
	[ ] Northern province
	[ ] Southern Province
	[ ] Kigali City
	[ ] Western Province

d. How many branches do you have? [ ] 0-5 [ ] 6-10[ ] 11-20 [ ] Other, please specify:
e. Who are your main competitors per sector? Please specify:
f. What share of the market do you hold? [ ] 1-10 per cent [ ] 11-20 per cent [ ] 21-30 per cent [ ] 31-40 per cent [ ] Other, please specify:

2. What kind of financing do you provide? [ ] loans [ ] savings [ ] insurance [ ] Other, please specify:
   a. What are your most popular products / familiar products to clients? Please specify:
   b. Do you offer mobile banking / payment solutions? [ ] Yes [ ] No
   c. Do you issue [ ] credit/ [ ] debit / [ ] both debit and credit cards for your retail clients?
   d. If so, how many are your active credit/debit cardholders? # of credit cardholders [ ], # of debit cardholders [ ]
3. Do you have a green credit line? [ ] Yes [ ] No
   a. If yes, please specify?
   b. If not, would you be interested in developing a green credit line? [ ] Yes [ ] No
   c. What kind of support would you require to establish a green credit line? Please specify
   d. What type of product would you be the most interested in financing through such a green credit line?
      [ ] refrigerators [ ] air-conditioners [ ] solar PV [ ] other, please specify
4. How comfortable are you financing clients' investment in energy efficient equipment?
   [ ] comfortable [ ] very comfortable [ ] we do not finance clients' investment in energy efficient equipment
   Any reasons for your answer?
   a. How popular is financing of investment in energy efficient equipment for your clients (i.e. retail, SME/corporate, institutional)?

	Explanation
Retail	[ ] not popular [ ] popular [ ] very popular
SME	[ ] not popular [ ] popular [ ] very popular
Corporate	[ ] not popular [ ] popular [ ] very popular

Other	[ ] not popular [ ] popular [ ] very popular

b. Do you already finance suppliers of energy efficient equipment (e.g. HVAC companies, retailers, others, …)? [ ] Yes [ ] No
c. Do you perceive any risk in financing energy efficient equipment? [ ] Yes [ ] No
d. If yes, why?
e. What are the key barriers to financing energy efficient equipment?
[ ] Late repayment of loans [ ] Inability to pay loans [ ] Other, please specify:

5. Do you have an Environmental and Social Risk Management System? [ ] Yes [ ] No
6. How would you like to be involved in the RCOOL residential project?
[ ] Provide feedback on draft documents [ ] Help raise awareness [ ] Assist with capacity building activities [ ] Participate in waste management activities [ ] Help pilot new financial mechanisms [ ] Other, please specify:
7. Who else from your sector do you recommend should be involved in the RCOOL residential project in some way,and how should they be involved?

APPENDIX IV: Questionnaire for Stakeholders (Agencies, Utilities, NGOs, Industry Organizations, Technical Institutes)

Responses to this questionnaire are of critical importance to properly understand the market for refrigerators and air conditioners in the country. The results will be used by UN Environment to help inform recommendations on policies, programs and innovative financial mechanisms to increase adoption of energy-efficient products. UN Environment will treat questionnaire responses as business-sensitive information. The findings will be aggregated across the pool of organizations that participate to avoid attribution to any particular entity.

Organization	Point of Contact Name	Title	Email	Phone

1. Is your organisation active country wide? [ ] Yes [ ] No
   a. If not, where?
      [ ] The whole country [ ] Kigali City [ ] Eastern Province [ ] Southern Province [ ] Western Province [ ] Northern Province
   b. How many employees or members are there?
      [ ] 0-10 [ ] 11-20 [ ] 21-30 [ ] 31-40 [ ] Other, please specify:
   c. What is your specific interest or area of expertise in energy efficiency?
      [ ] Refrigerators [ ] Air-conditioners [ ] Both [ ] Other, please specify:
   d. Do you have on going / planned activities related to energy efficiency?
      [ ] Yes [ ] No
   e. If yes, what is the planned activity?
      [ ] Awareness creation [ ] Sale of products [ ] Repair and maintenance training [ ] Other, please specify:
   f. Is your organisation more interested in energy efficiency initiatives in the residential, in the commercial, or in the public sector?
      [ ] Residential sector[ ] Commercial sector [ ] Public sector
   g. Have you produced any relevant studies or reports on energy efficiency in the residential sector?
      [ ] Yes [ ] No
      If yes, kindly provide details

2. Is your organisation concerned with the energy efficiency of refrigerators or air conditioners? [ ] Yes [ ] No
   Why? [ ] Cost saving [ ] Environment protection [ ] Other, please specify:

If so, how is your organisation addressing it? [ ] Investing in efficient products [ ] Training the staff to be energy efficiency conscious [ ] Using alternatives whenever we can

a. What barriers do your organisation face in this area?
   [ ] Lack of awareness [ ] Inadequate capacity [ ] Lack of funding or financing options [ ] Regulatory hurdles [ ] Other, please specify:
b. What would help overcome these barriers?
   [ ] Awareness campaign [ ] Capacity building [ ] Availability of funding or finance options [ ] Regulations [ ] Other, please specify:

3. Is your organisation concerned with the refrigerant gasses used in these products? [ ] Yes [ ] No
   a. Why? Please specify:
   b. If so, how is your organisation addressing it (specify what is underway, and what is planned for the near future)?
      [ ] Investing in new technologies [ ] Using alternatives whenever we can [ ] Other, please specify:
   c. What barriers do your organisation face in this area?
      [ ] Lack of awareness [ ] Inadequate capacity [ ] Lack of funding or financing options [ ] Regulatory hurdles [ ] Other, please specify:
   d. What would helpovercome these barriers?
      [ ] awareness campaign [ ] capacity building [ ] availability of funding or finance options [ ] regulations [ ] other, please specify
   e. Are you aware about global warming and climate change? [ ] Yes [ ] No
   f. Are you taking or planning to take actions? [ ] Yes [ ] No

4. What do you hope to have addressed in the national policies recommendations and the financial mechanism that will be developed through the RCOOL residential project?
   [ ] awareness campaign [ ] capacity building [ ] availability of funding or finance options [ ] regulations [ ] other, please specify

5. How would you like to be involved in the RCOOL residential project?
   [ ] Provide feedback on draft documents [ ] Help raise awareness [ ] Assist with capacity building activities [ ] Participate in waste management activities

6. Who else from your sector do you recommend should be involved in RCOOL residential project in some way and how should they be involved?
   Please specify