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CURRENT AND FUTURE E-WASTE FLOW IN GEORGIA

December, 2017

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This document was prepared in the frame of the project “Supporting the introduction of Extended Producer Responsibility (EPR) principle as required by the Waste Management Code”. The project was initiated by the Ministry of Environmental Protection and Agriculture of Georgia and supported by UNDP/Sida. It was implemented by Georgia’s Environmental Outlook - GEO with expert support from the German think tank "adelphi" and local consulting company - PMO.

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ABBREVIATIONS

AC	Air Conditioner
CAGR	Cumulative Annual Growth Rate
EEE	Electrical and Electronic Equipment
EU	European Union
GDP	Gross Domestic Product
GEL	Georgian Lari
POM	Put On the Market
RS	Revenue Service of the Ministry of Finance
SPA	State Procurement Agency
WEEE/E-waste	Waste Electrical and Electronic Equipment
USD	US Dollars
UNU	United Nations University

METHODOLOGY

Introduction

The objective of this study is to conduct a baseline analysis on past and current flows of e-waste, identify growth drivers and main characteristics of the sector and develop a forecast for evaluation of future flows of e-waste on selected goods.

In order to reach set out objectives, we have divided the total market into three main players – government, household and corporate sector and used several data collection methods to analyze information for all three segments. Information collection methods used include:

1. Structured interviews with key informants and experts[1];
2. Data requests made to key sources of information;
3. Desk review of existing data sources, qualitative and quantitative studies; and
4. Online household survey

Research Scope

Due to limited scope and difficulty of obtaining relevant data, we have focused on the minimum requirements of e-waste statistics identified by United Nations University[2]:

- Washing machines (UNU key: 0104)
- Fridge or combined fridge/freezer (UNU key: 0108)
- Household Air conditioner (UNU key:0111)
- CRT monitors and TVs (UNU key: 0308
- Laptop, notebook, tablet (UNU key:0303)
- Mobile phones (UNU key: 0306)
- Flat panel display for computer (UNU key: 0309)
- Flat panel televisions (UNU key:0408)

Based on UN University methodology, a selection was made using the following criteria:

• The product comprises a significant share of the total market size in terms of weight. These products could include washing machines and refrigerators and air conditioners; or

• The product contains environmentally toxic components. Such products include refrigerators and air conditioners; or

[1] List of people met is provided as an annex
[2] http://i.unu.edu/media/unu.edu/news/49515/E-waste-Guidelines_Partnership_2015.pdf

• The product contains a very high concentration of valuable resources, which would otherwise be lost if they are not properly recycled. Such products include IT equipment, mobile phones and flat panel televisions or monitors; and

• The product should be on the market for both developing and developed countries.

We have taken minimum requirements as a starting point for the research, but since Georgian official sources use different classifications for goods, we have shifted to the classification available in Georgia. During the selection process, the UNU classification was approximated to local data and as a result, the study has focused on the following categories for the entire analysis:

- Fridge
- Household Air conditioner
- Washing machine
- Dishwashing machine
- Oven
- Television
- Mobile phone
- Portable Computers (Laptop/tablets)
- CRT Monitors

Sources of Information

The sources of information used for this study include:

National Statistics Office of Georgia (Geostat) – at the outset of the project an official data request form was submitted to the statistics office of Georgia. Information requested included local production volumes of selected goods, import-export statistics of selected goods. The data for years of 2005-2016 was analyzed.

State Procurement Agency - information was requested on procured volumes of selected electronic goods public organizations in order to identify consumption patterns. Information was available for 2013-2016.

Service Agency of the Ministry of Finance of Georgia – information was requested on the volumes of discarded electronic goods, disposal methods and average lifespan of selected EEE in public sector. Data were acquired for the years of 2012-2016

Importers of electrical and electronic devices – interviews with five key importer enterprises, such as Altaokay, UGT, ACC Distribution, Orient Logic and Itechnic, were conducted in order to get information about the market volume, product categories and their lifecycle, major consumer groups, regional distribution and future trends of the market development.

Firms operating in technology sector – large telecom organizations and other technology firms who use variety of electrical and electronic equipment gave information on product lifespan, disposal practices and problems encountered during the process of disposing e-waste.

Industry experts – provided insights on the future and current market trends and market drivers.

Desk research – of various methodological documents and studies in order to identify research techniques and conduct comparative analysis with EU countries. Documents reviewed included**:**

1. E-waste statistics, Guidelines on classification, reporting and indicators, 2015 – United Nations University (UNU);
2. Analyzing End of life LCD TV WEEE Flows in Europe, Farzaneh Fakhredin, Jaco Huisman;
3. The Global E-waste Monitor, 2014, Quantities, flows and resources, United Nations University;
4. Quantifying Waste of Electrical and Electronic Equipment in Romania, 2015, United Nations University;
5. Influence of Products Useful life on the Environment: Creation of Information Base for the Development of Strategies Against "obsolescence", 2016, Umwelt Budensamt.

Online household survey –with the target of 378 respondents in order to get information regarding average lifespan of selected EEE, stock volumes, disposal methods and preferences.

EXECUTIVE SUMMARY

Unless indicated otherwise, all the information and data provided in this document are for the researched categories described in the methodology.

Overview of EEE market in Georgia

Total market for EEE for selected categories of goods has reached 14.6 thousand tonnes in 2016 growing by 6.7% CAGR[3] in eleven years' period.

Georgian EEE market is import driven with less than 1% of local production, therefore currency fluctuation is having a major effect on the market.

Consumers in Georgia frequently buy non-brand electronic and electrical devices in lower price range, which are not supported by the warranties and become easily dysfunctional. Consequently, the average lifecycle of certain products is lower in Georgia compared to EU countries.

Georgia generates four times lower e-waste than EU countries. According to Step-initiative database, Georgia generated 4.6 kg e-waste per inhabitant, while EU average stood at 18.7kg in 2014. The reason behind the higher waste generation in Europe lies in higher consumption of EEE compared to developing countries, such as Georgia.[4]

For the researched 9 categories the total volume of e-waste amounted to 15.7 thousand tonnes and 4.2 kg per inhabitant in 2017. By the rough estimation the total e-waste in 2017 might account to 29.1 thousand tonnes, which is 7.8 kg. per inhabitant.[5]

E-waste concentration in municipal landfills is very low (less than 0.1%). Low levels can be attributed to household behavior to store or giveaway electronic devices as well as to informal collectorswho use electronic waste as a source of income by delivering it to scrap collectors.

Regional Distribution

EEE Market is concentrated in capital city and main regional hubs such as Kutaisi and Batumi. Tbilisi leads EEE market by 48% of sales, followed by Adjara 13% and Imereti 11%.

Market is immature in rural areas and most of the residents do not own essential household appliances like ovens, dishwashing machines, washing machines and air conditioners.

Consumer Segments

[3] The compound annual growth rate (CAGR) is the mean annual growth rate of data over a specified period of time longer than one year.

[4] Step initiative is a global initiative created to develop solutions to address issues associated with Waste Electrical and Electronic Equipment (WEEE). It provides e-waste world-map representing comparable, country-level data on the amount of e-waste generated in most countries around the world. The figures provided above shows the total volume of e-waste (including 9 categories researched in this study) generated in Georgia in 2014.

[5] This estimation is not backed up by sufficient amount of data and needs further research for clarification. This estimation should not be considered as a reliable as it may contain a high margin of error and should only be used to get a general impression of the market.

Households usually keep small household appliances in stock and use home pick-up service of scrap dealers for large household appliances. According to household survey, households keep 3.8-unit end of life devices at home. Duration of storing end of life devices vary mostly between 1 to 5 years.

Lifecycle of office appliances are higher than household average. Based on the interviews companies change laptops in 5 years on average, Desktop PC in 7 to 10 years and Air Conditioners (AC) in 5 to 6 years.

Disposal of written off devices are complicated for companies who are engaged in import, production and distribution of EEE products. Based on the interviews, with key importers and resellers, the only way to dispose written off equipment is landfilling it in municipal polygon, under the supervision of Revenue Service representative. Strict guidelines do not concern other representatives of corporate sector and they simply sell end of life or written off devices via tenders or auctions.

Forecast

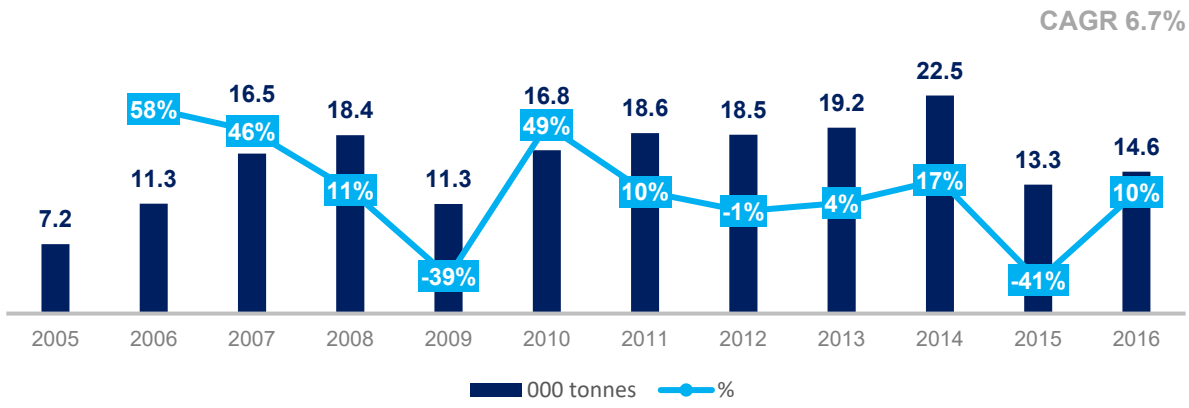
Based on the forecast EEE consumption for analyzed 9 categories will reach 52 thousand tonnes in 2027, growing at a rate of 12.5 CAGR in 10 years' period. The main drivers of growth are economic development, technological innovations and product accessibility.

OVERVIEW OF ELECTRICAL AND ELECTRONIC EQUIPMENT CONSUMPTION IN GEORGIA

EEE in Georgia is increasing by 6.7% CAGR[6] standing at 14.6 thousand tonnes in 2016. Market of EEE is import driven with less than 1% of local production. There is only one producer of white household goods Fresh Georgia, Kutaisi based plant assembling ovens, microwaves, fridges, washing machines and TV's in small quantities. Another producer of telecom appliances is AG Microelectronics; Rustavi based plant assembling TV's and WIFI receivers. Besides household goods, there are numerous small assembly lines producing portable and desktop computers with the average amount of 10,000 devices annually.

Major importers of electronic appliances are China, United Arab Emirates and Turkey. Import of electronic appliances is characterized by volatility. As the market is import driven, currency fluctuations have a huge effect on it. Major drops in import occurred in 2009 and 2015. The reason behind the 2009-year slump was post-war crisis, which affected all sectors of the economy. Another downturn in 2015 is attributed to devaluation of Georgian Lari, when average annual exchange rate from Gel to USD went up from 1.76 in 2014 to 2.26 in 2015.

Figure 1 – EEE put on the market 2005-2016



SOURCE: GEOSTAT

Average lifecycle of EEE in Georgia compared to EU countries vary by product. In terms of fridges, mobile phones and laptops, average lifecycle in Georgia is higher compared to EU countries. Higher lifecycle can be attributed to economic strength of the country and average salaries. The higher the salary, the more money can be spent on luxury goods, including EEE. On the other hand, AC, washing machine, oven and

[6] The compound annual growth rate (CAGR) is the mean annual growth rate of data over a specified period of time longer than one year.

desktop PC figures are lower in Georgia. One of the reasons for the lower durability of EEE in Georgia is that consumers frequently buy non-branded, low quality products, which frequently get out of order and are not covered by the warranties. Another reason for lower lifespan could be different consumption patterns in Georgia compared to other countries. For instance, most corporate firms use household air conditioners instead of cooling systems. The heavy usage of the device by corporate sector might cause early failure compared devices used only by households.

Table below represents comparison of average lifecycle of selected devices in EU Countries and Georgia, derived by government, corporate and household sector analysis:

Figure 2 – Average lifecycle by product in years, Georgia 2017, selected EU countries 2014-2015

Product	Average lifecycle	EU Figures[7]
Fridge	12.8	12.5
Washing machine	9.6	10.5
Dishwashing machine	6.3	7.1
Air conditioner	8	10.5
Oven	9.1	14.6
Television	10.6	8.85
Mobile phone	4.1	2.4[8]
Laptop/tablets	4.1	2.5
Desktop computer	6.7	7.1

SOURCE: United Nations University, PMO analysis

Based on the average lifecycle and EEE put on the market, we have identified that waste generated by selected 9 categories equals to 15,700 tonnes in 2017. That is 4.2 kg electronic waste generated by selected 9 categories per inhabitant.

According to Step-initiative database, Georgia generated 21 thousand tons of electronic waste in total (all categories) in 2014, which amounts to 4.6 kg[9] per inhabitant. EU average for 2014 stood at 18.7 kg per inhabitant, four times larger than Georgia's figure. Based on our research, selected 9 categories accounted

[7] All figures, except mobile phone data, are derived from UNU study and represent collection of average lifespan amounts of products in Belgium, Netherlands and France in 2014-2015: https://i.unu.edu/media/ias.unu.edu-en/project/2238/E-waste-Guidelines_Partnership_2015.pdf

[8] UK report 2006: https://www.gsma.com/publicpolicy/wp-content/uploads/2012/03/environmobilelifecycles.pdf

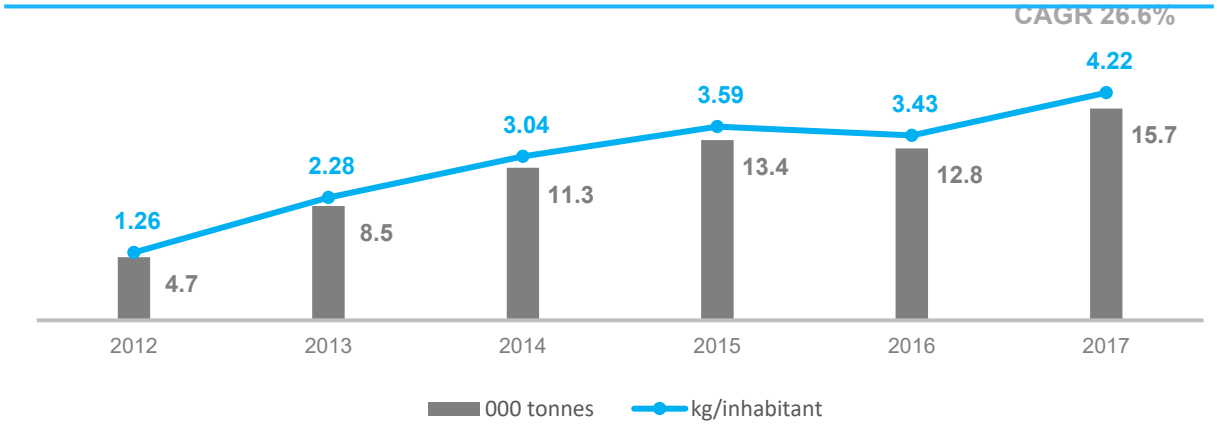
[9] Step initiative is a global initiative created to develop solutions to address issues associated with Waste Electrical and Electronic Equipment (WEEE). It provides e-waste world-map representing comparable, country-level data on the amount of e-waste generated in most countries around the world. The figures provided above shows the total volume of e-waste (including 9 categories researched in this study) generated in Georgia in 2014. Data from 2014 is the latest update of Step-initiative. http://www.step-initiative.org/Overview_Georgia.html

for 11.3 thousand tons of e-waste in 2014, which is equivalent to 54% of total e-waste generated according to the UNU estimate.

Due to the lack and reliability of data on generated e-waste, as well as absence of generalized figure on share of selected 9 categories in overall EEE, it is difficult to provide specific amounts of total e-waste generated in Georgia in 2017. One more reason behind this is the permanent change in EEE use patterns (e.g. decreased use of monitors, increasing trend of washing machines, etc.). However, based on above judgement, a very rough estimation of total e-waste in 2017 is 29.1 thousand tonnes, which is 7.8kg per inhabitant.[10]

Georgia's figure is low in comparison to developed countries as the consumption of electronic devices is highly dependent on economic strength and welfare.

Figure 3 – E-waste for selected categories of products (tons), 2012-2017[11]



SOURCE: GEOSTAT

Despite the fact that waste separation in Georgia is not available and people throw e-waste directly to municipal waste, concentration of e-waste in the municipal waste is very low. According to the research carried out by LTD Tbilservice Group in Tbilisi Waste Polygon in 2014, only 0.1% of e-waste gets into landfill. Similar studies were undertaken in Adjara and Kakheti where e-waste constituted of 0.5% and 0.7%, respectively. Research is ongoing in Shida Kartli, by the preliminary results concentration of e-waste in municipal stream in Shida Kartli is 0.8%. One factor for low concentration of e-waste in municipal stream might be attributed to informal sector representatives, who either sort waste from municipal waste bins or collect outdated devices from households and take out electronic devices to get money from scrap collectors.

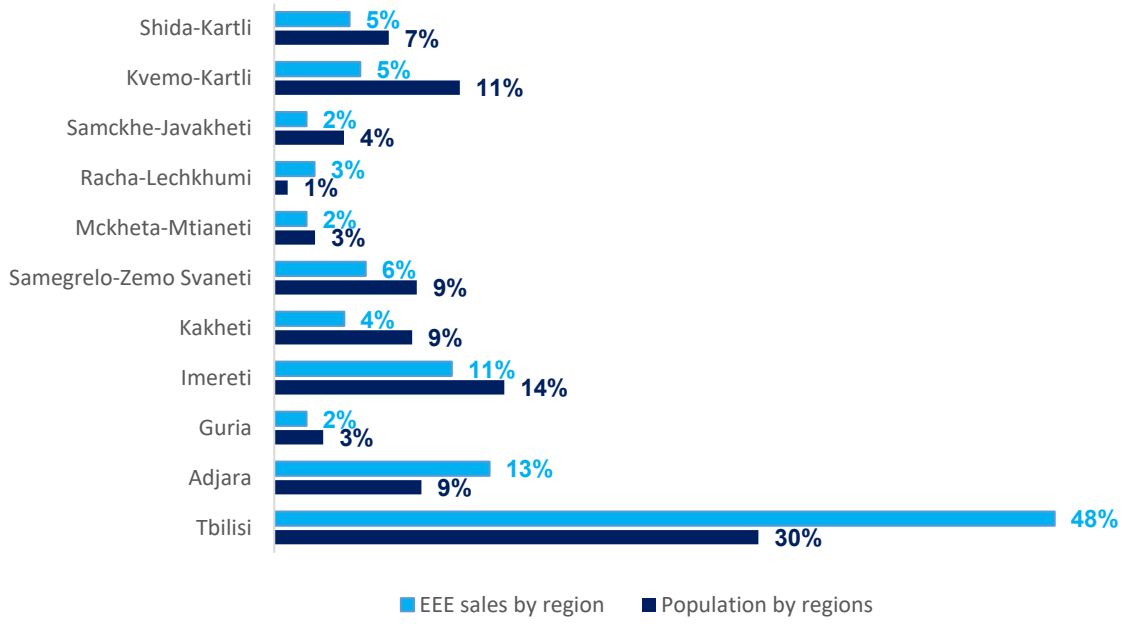
[10] This estimation is not backed up by sufficient amount of data and needs further research for clarification. This estimation should not be considered as a reliable as it has high margin of error and could only be used to get a general impression of the market.

[11] Numbers presented by years is not cumulative and shows the volume of e-waste for selected category per year.

Regional Distribution

According to industry experts, market is very concentrated in terms of EEE sales. Capital Tbilisi holds 48% of total market followed by Adjara region headed by Batumi, which is the most popular sea resort in Georgia. Imereti with the regional center of Kutaisi holds 11% of the market. As stated by the industry experts, the market is still immature in the regions and many households do not own electronic devices, such as ovens, dishwashing machines, washing machines and air conditioners.

Figure 4 – EEE sales distribution by regions and population, 2017



SOURCE: PMO Analysis

In terms of population distribution, Tbilisi is leading with 30% of total population, followed by Imereti and Kvemo Kartli with 14% and 11% respectively.

Description of Consumer Segments

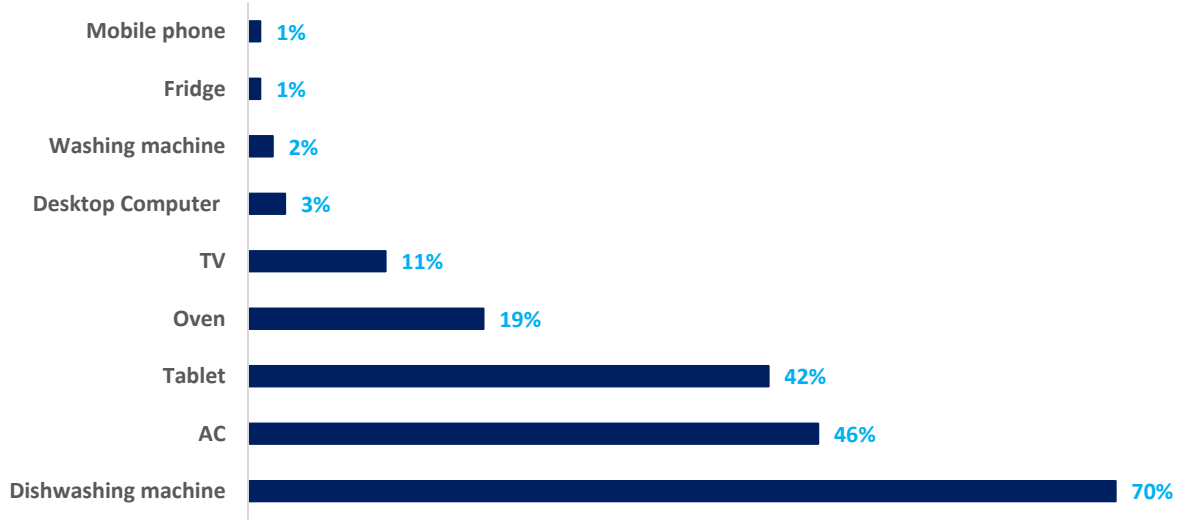
This section describes consumer segments of EEE market in Georgia. The section is divided into three parts, separately analyzing characteristics of household, corporate and government segments.

Households

As mentioned above, household sector in Georgia is still immature and there are gaps in consumption of various devices. The most uncommon device for Georgian market is dishwasher. According to the

household survey, 70% of respondents do not own dishwashing machine, followed by air conditioners with 46%. On the other hand, mobile phone is the most widespread device, which is owned by more than 99% of respondents. The chart below demonstrates the percentage of respondent who do not own listed electronic devices:

Figure 5 – Percentage of respondents who do not own listed electronic devices



SOURCE: Household Survey, 2017

Based on the survey, households behave differently while choosing disposal methods, however keeping out of order devices at home is the most common behavior. 70% of respondents are keeping out of order devices at home. Duration of storage varies, but the majority (62%) of households keep end of life devices for 1 to 5 years.

On average, 3.8 units of devices are kept in stock per household. Mostly stored items are mobile phones, laptops and TVs. Storing end of life electronic devices at home is mostly attributable to older generation who think that out of order device might still be useful.

In terms of large household appliances, the most popular method of disposal is passing end of life devices to scrap collectors. The second most popular disposal method for large household appliances is giveaway, followed by home storage.

Items like mobile phones, computers and TVs, households mostly store them at home, as they need less space than large appliances. The second most popular method is giveaway of the above listed items.

Frequency of change varies product by product. For some devices such as washing machine, oven AC or tablet households wait until it reaches the end of life to change the device. For other devices, like TVs mobile phones and computers, households still buy new device despite the fact that the old one is still working.[12]

Corporate

Lifecycle of office appliances in corporate sector varies by companies. On average, laptops are used for 5 years, desktop computers for 7 to 10 years and air conditioners - 5 to 6 years. Companies who are heavy

[12] More details on research are presented in Annex 1

users of EEE such as banks and companies working in telecommunication, generally sell written off or out of order appliances via tenders or auctions.

Disposal of written off devices is an important issue for EEE distributor and reseller companies. The government strongly controls the disposing process of written off devices. These type of companies should report to Revenue Service (RS) of the Ministry of Finance of Georgia on volumes of written off devices and dispose it at official landfill with the presence of RS representative. Based on our research, representatives of such companies consider the landfilling process long, inconvenient and expensive, due to extra transportation costs, and many of them keep written off devices in stock.

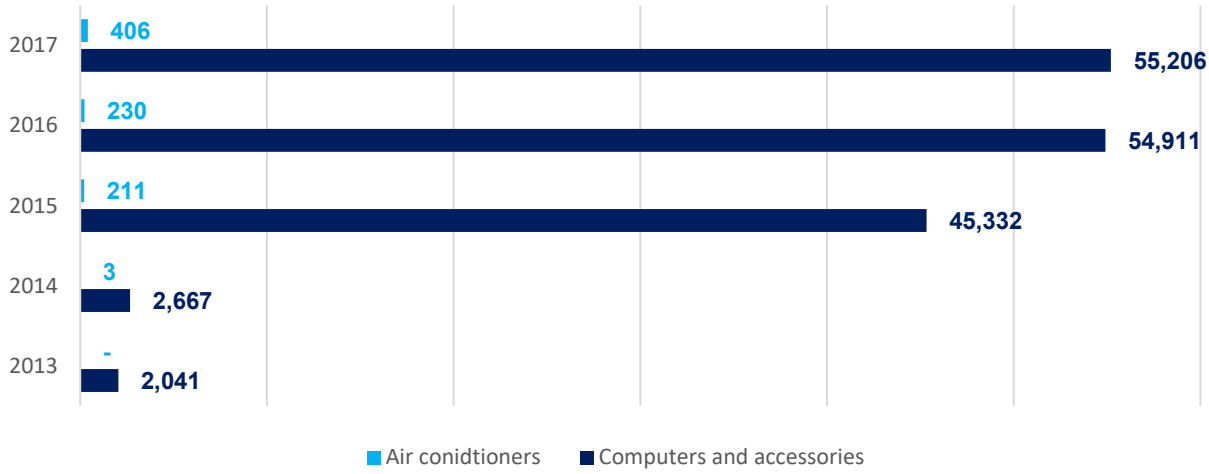
Repair shops do not face such strict regulations and they dispose spare parts directly in municipal waste bins.

Government

Government sector has a structured system for purchasing and disposing electronic devices. State Procurement Agency (SPA) is a public body, which coordinates and monitors procurement of all the goods and services consumed by government organizations. Most of the goods and services are procured via tenders. Public organizations can only purchase goods independently with a value less than 5,000 GEL per year for one product category; therefore, most goods and services are procured via tenders.

Based on the information provided by SPA, the volume of computers purchased by public sector is increasing over years and in 2017 accounted to 55 thousand. Computers and monitors are the largest category of electronic devices purchased by government organizations.

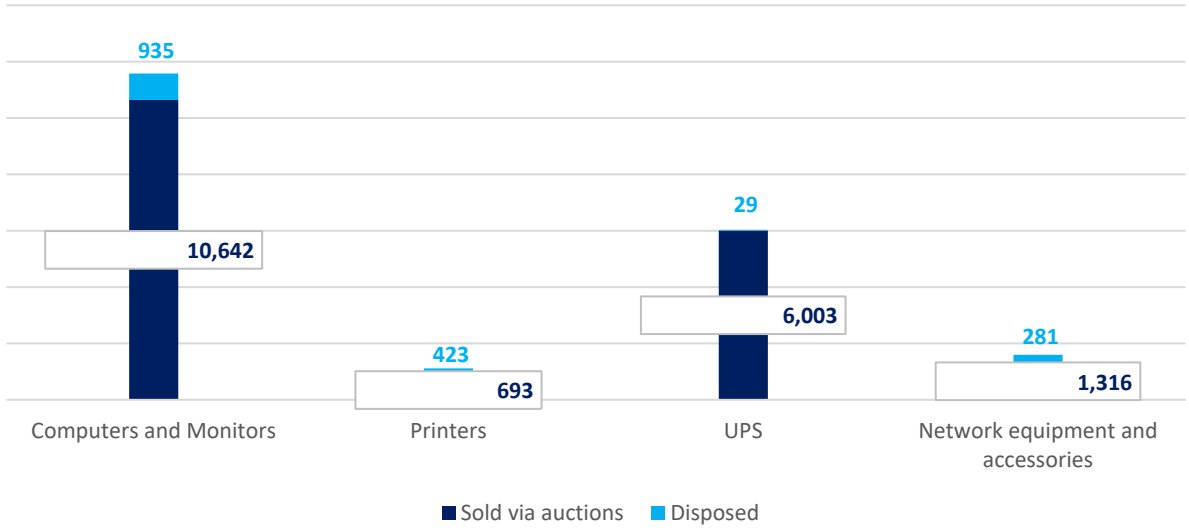
Figure 6 – Procurement volume of EEE via tenders for governmental organizations, 2013-2017



SOURCE: State Procurement Agency

On the other hand, Service Agency of the Ministry of Finance of Georgia is responsible for collection of out of date equipment from public organizations, yet with some exceptions. For instance, old fax machines and printer cartridges are not collected by the agency and they are stocked in the organizations. After collecting the equipment, service agency categorizes received devices. Most of the items are sold via online auction through www.eauction.ge portal. Other devices that reached the end of life and could not be used are disposed of by certified organizations. The chart below provides information on collected and disposed electronic devices in years 2012-2016:

Figure 7 – Volume of EEE collected and disposed by Service Agency, 2012-2016



SOURCE: Service Agency of the Ministry of Finance

Fridge

Georgia is an import driven country with complete majority of fridges imported from various countries. The main importers of fridges are China (on average 45%) and Thailand (on average 30%).[13] There is only one plant, which produce minor quantity of fridges locally.

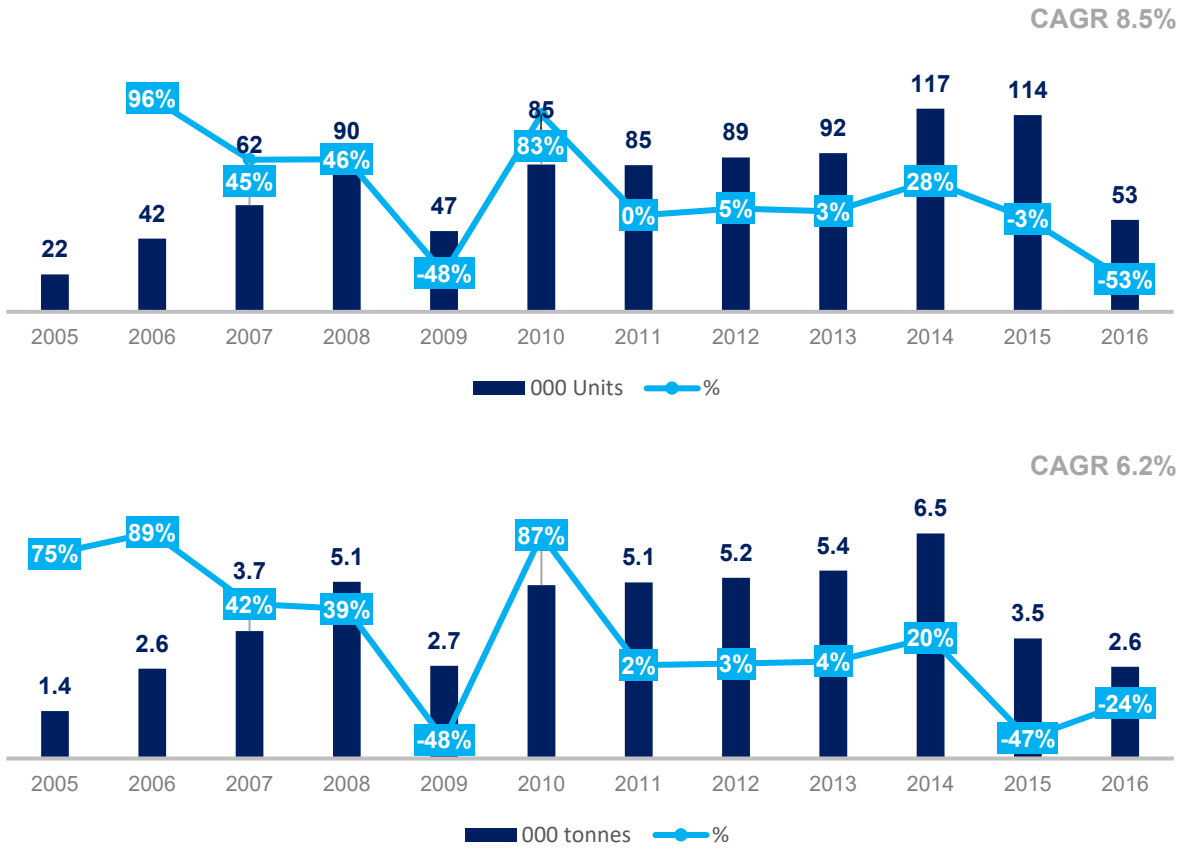
Import of fridges has been very volatile showing brisk falls and rises. Major drop visible in 2009, which is mostly attributed to the global financial crisis that improved shortly in 2010. Imported volumes start to drop continuously from 2014, which is mostly attributable to currency devaluation. Despite the volatility, Compound Annual Growth Rate (CAGR) is positive showing 8.5% growth in volume in 11 years' (2005-2016) period.

Households are buying less fridges than before. In 2010, the number of pieces acquired per 1000 inhabitant equaled to 19, while the number dropped to 14 in 2016. However, this declining trend cannot not be

[13] UN Comtrade Database

attributed to market saturation. As industry players stated that many households, especially in rural areas, do not own basic appliances including fridges.

Figure 8 – Fridges put on the market 2005-2016



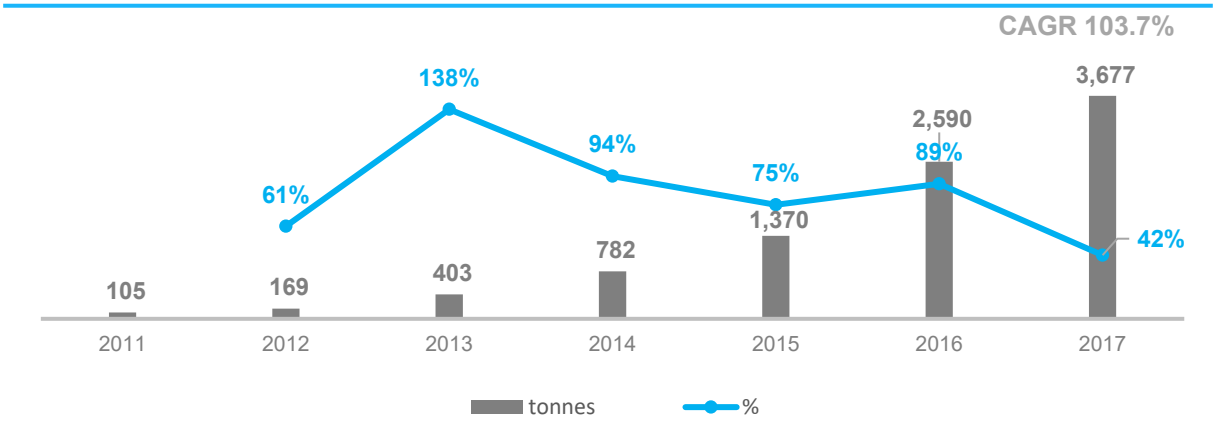
SOURCE: GEOSTAT

Based on the research, average lifecycle of fridges in Georgia is 12.8 years, with minimum of one and maximum of 38 years in working condition. Usually, fridges are replaced when they quit working. Based on the household survey, only 35% of respondents buy new one despite the fact that the old one is still working.

Waste generated from fridges are increasing over years, showing 103% CAGR in last five years and reaching 3,600 tonnes in 2017. People mostly tend to get away from fridges when it quits working as mentioned above. Only 21 % of respondent's store broken fridges at home, others give away or throw it in the garbage.

The graph below depicts the volumes of waste generated by end of life fridges.

Figure 9 – Waste generated by fridges (tonnes), 2011-2017[14][15]



SOURCE: GEOSTAT

Household Air Conditioner (AC)

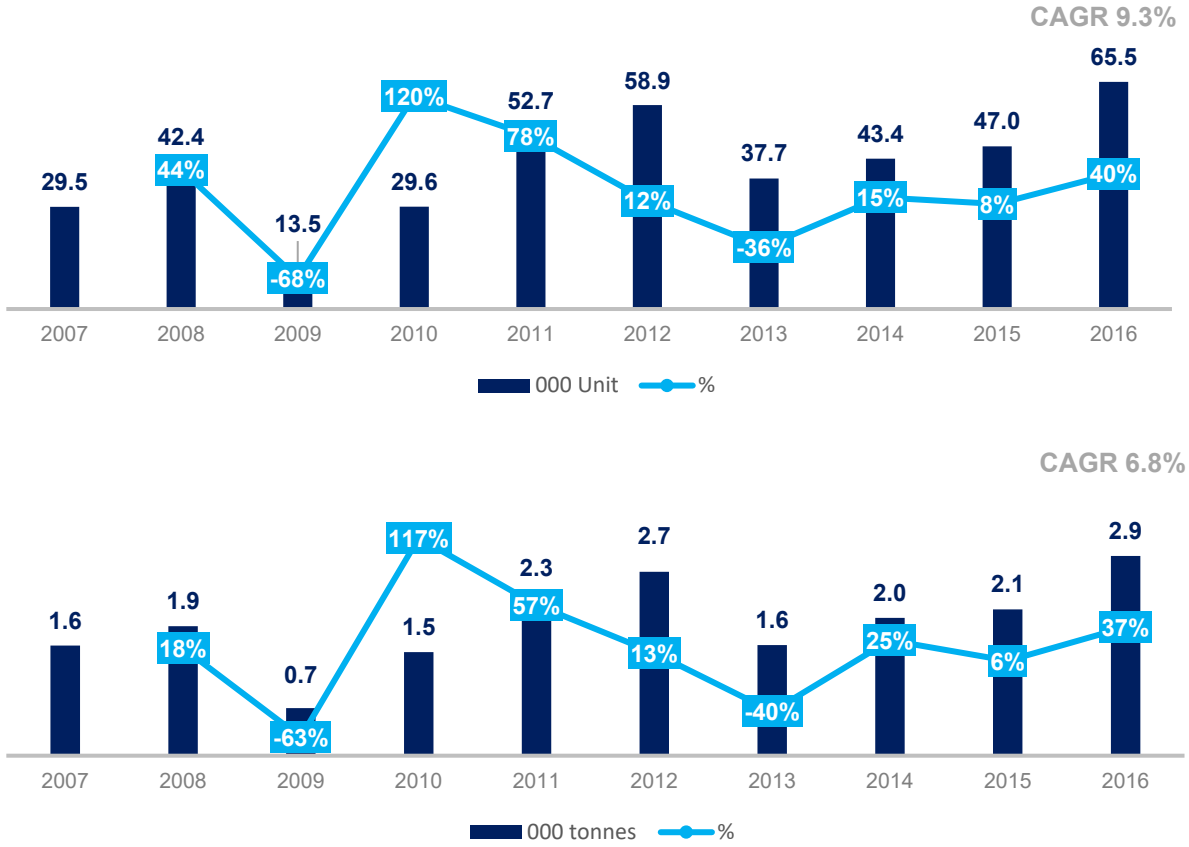
There is no local production of ACs in Georgia. The absolute majority of ACs are imported from various countries. The main importers are China and Turkey. In overall, households as well as the corporate and government sector use conditioners. Usage of air conditioners in households is still low. By the results of household survey, 70% of respondents do not own air conditioner. However, demand for AC is growing year over year by 9.3% CAGR, reaching 65.5 thousand units in 2016. Number of ACs per 1000 inhabitants are increasing accordingly, going up from 6.7 AC's in 2010 to 17.6 in 2016.

The dynamics of imported household air conditioners from year 2005 to 2016, in terms of units and tonnes are depicted below:

Figure 10 – Household air conditioner put on the market 2007-2016

[14] Low values for waste from fridges in 2011/12 is due to the fact that no data is available on fridge import before 2005t;

[15] Numbers presented by years is not cumulative and shows the volume of e-waste for selected category per year.

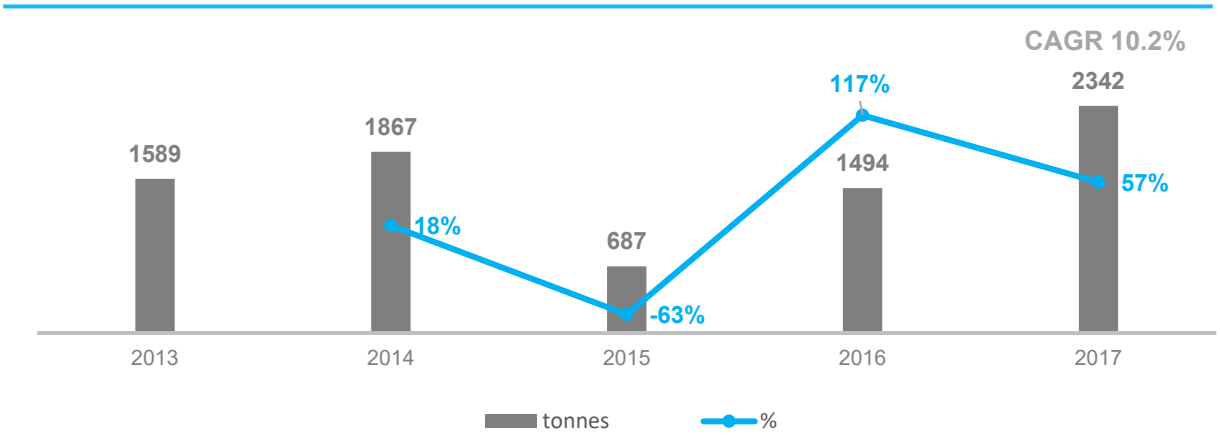


SOURCE: GEOSTAT

Based on the research average lifecycle of household air conditioners in Georgia is 8 years, with minimum of one and maximum of 35 years of service life. Average lifecycle is lower than EU average (10.5 years). The reason behind it might be different consumption patterns. In Georgia, household ACs are commonly used in corporate sector that brings higher load on device and might cause early failures.

Figure 11 – Waste generated by air conditioner (tonnes[16]), 2013-2017

[16] Numbers presented by years is not cumulative and shows the volume of e-waste for selected category per year.



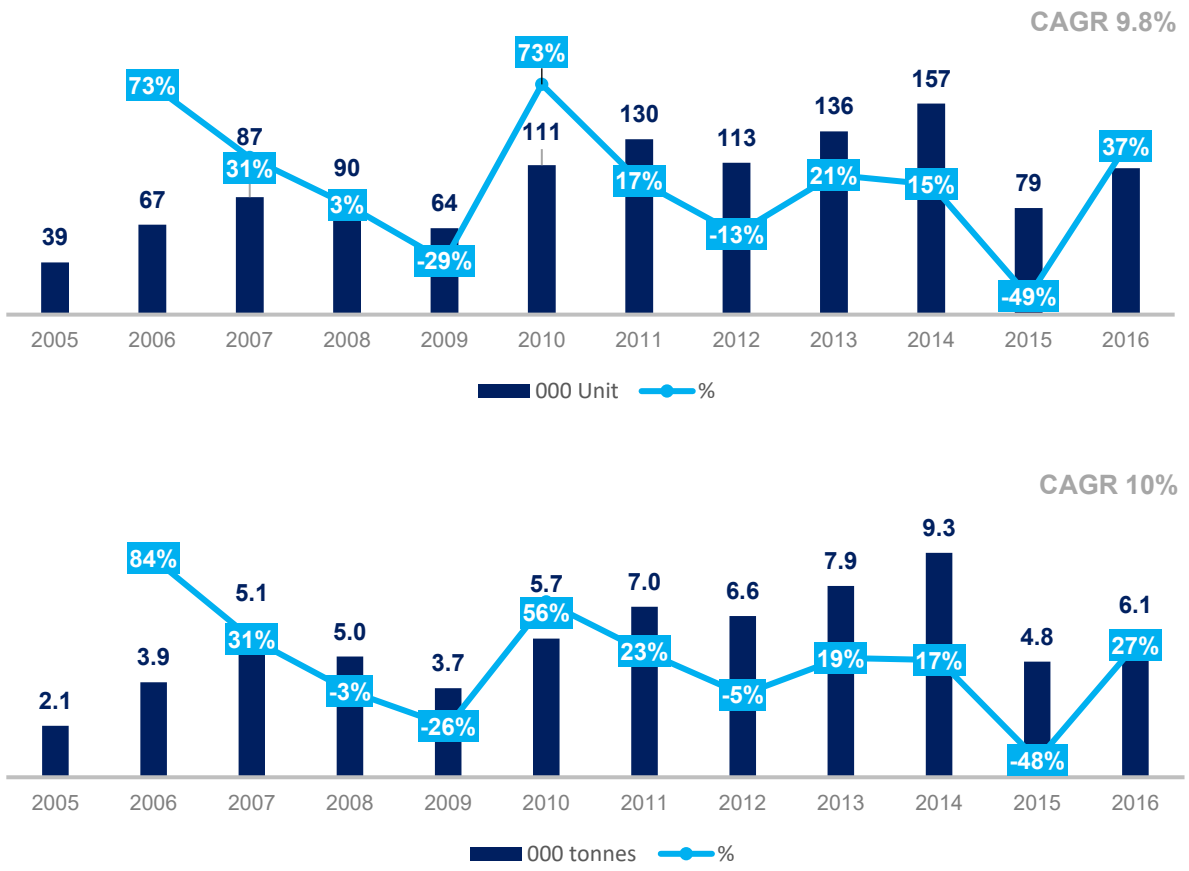
SOURCE: GEOSTAT

Waste generated by air conditioners was growing by 10.2% CAGR for the last five years, reaching 2,342 tonnes in 2017. A similar trend is expected over the next years, as the consumption of air conditioners is increasing.

Washing Machine

Washing machine imports are also characterized by volatility, mainly caused by currency fluctuations and economic instability. In 2016, 109,000 units of household washing machines were imported, which is 37% higher than in the previous year. Upward trend is expected in the future, as the market is expanding in the regions.

Figure 12 – Washing machine put on the market 2007-2016



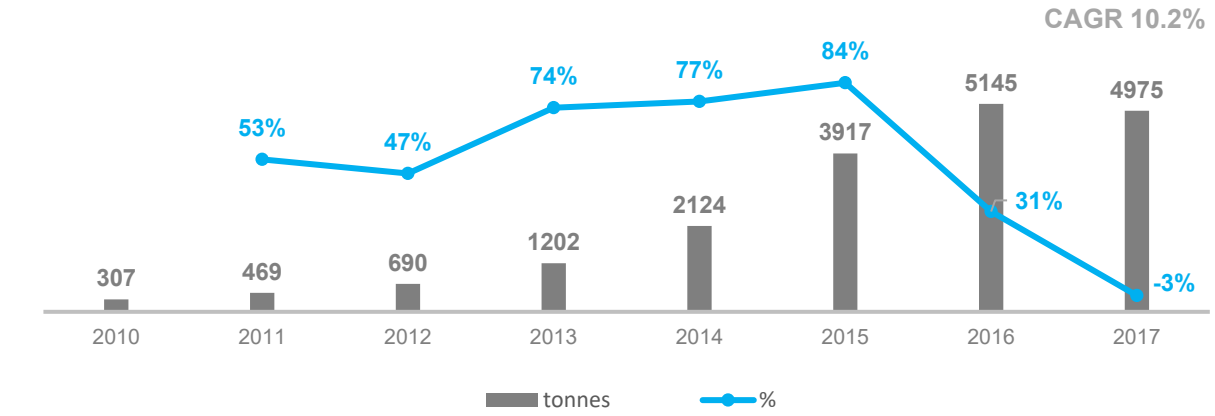
SOURCE: GEOSTAT

Based on the research, average lifecycle of washing machines is 9.6 years. Few cases reported the usage of washing machines for even 50 years. People mostly tend to keep washing machines before the end of life. Only about 30% of respondents changed the device despite the fact that the old one was still working.

People treat end of life washing machines differently. About 31% of respondents keep out of order washing machines at home, while 20% of respondents dispose it in household waste. The majority of the respondents (60%) give it away to scrap collectors.

Waste generated by washing machines is increasing at Compound Average Growth Rate of 10.2%, reaching 4,975 tonnes in 2017. The chart below shows waste generated by washing machines from 2010 to 2017.

Figure 13 – Waste generated by household washing machine (tonnes), 2010-2017[17]

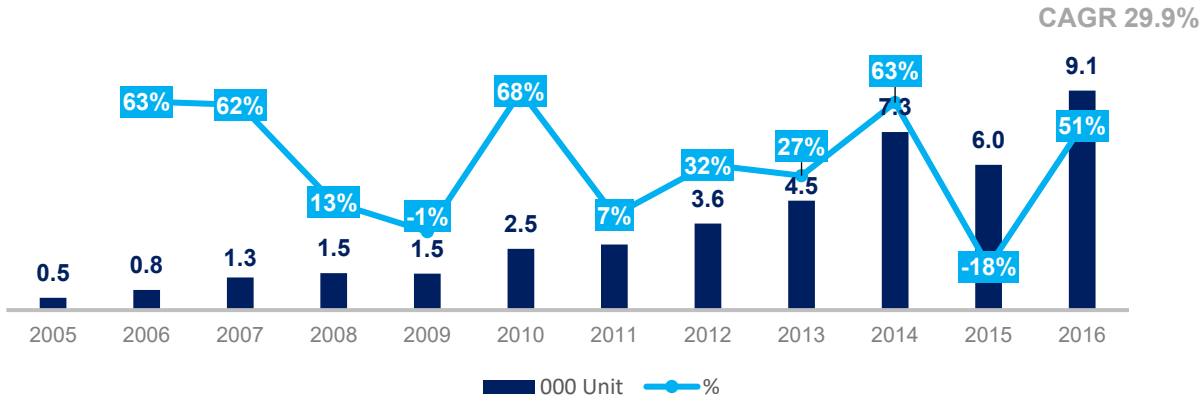


SOURCE: GEOSTAT

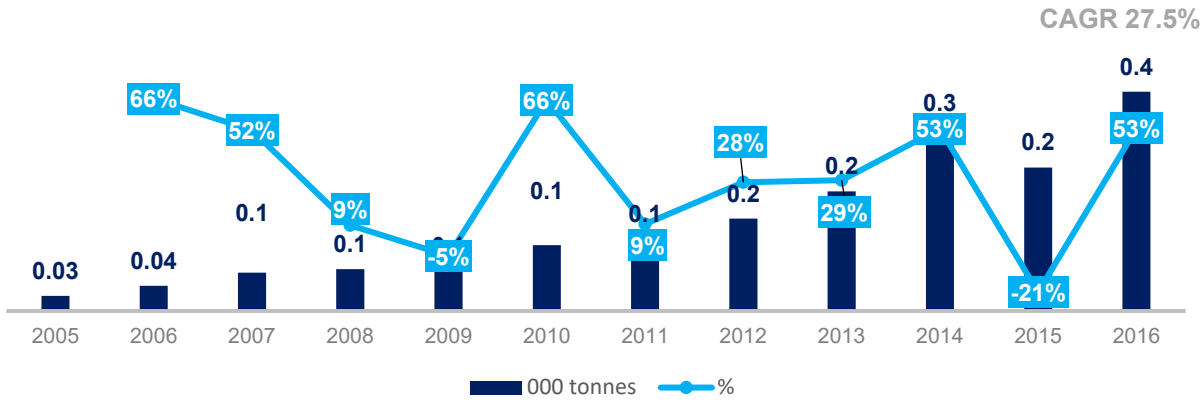
Dishwasher

Dishwashers are new product for Georgian market, which has gained popularity in the last three years. Majority of households still do not own dishwashers which is the main reason of low levels of import. In 2016, 9,100 Dishwashers were imported in Georgia, which is 51% higher than the previous year's figure. CAGR for 11 years reached approximately 30%.

Figure 14 - Dishwasher put on the market 2005-2016



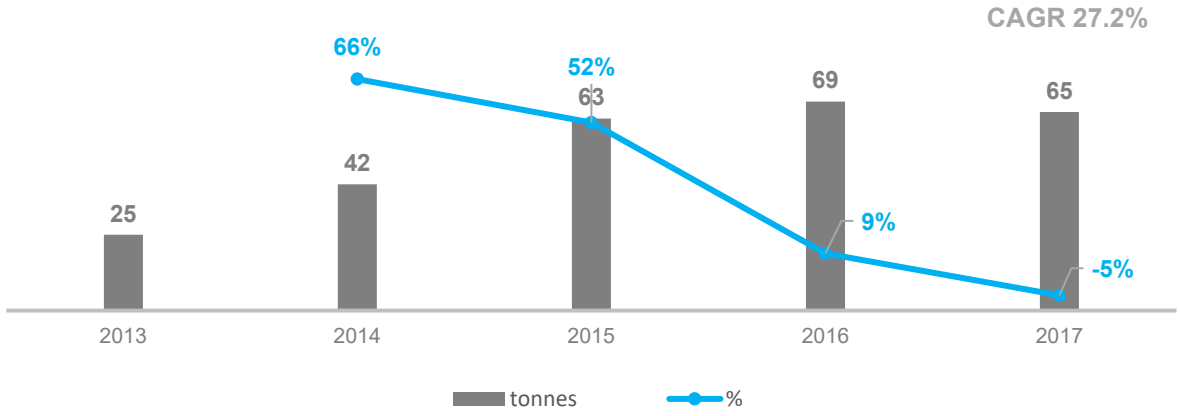
[17] Numbers presented by years is not cumulative and shows the volume of e-waste for selected category per year.



SOURCE: GEOSTAT

As mentioned before, according to household survey 70% of households do not own dishwashing machine. Industry experts think that the main reason for the low demand is that households do not find dishwasher as an essential tool. Product has low awareness and some households who do not own the machine think that it is inefficient and inconvenient to use due to the long duration of cycles and the quality of washing. Despite that, demand on dishwashers is increasing by 27% on average.

Figure 15 – Waste generated by dishwashing machine (tonnes), 2013-2017[18]



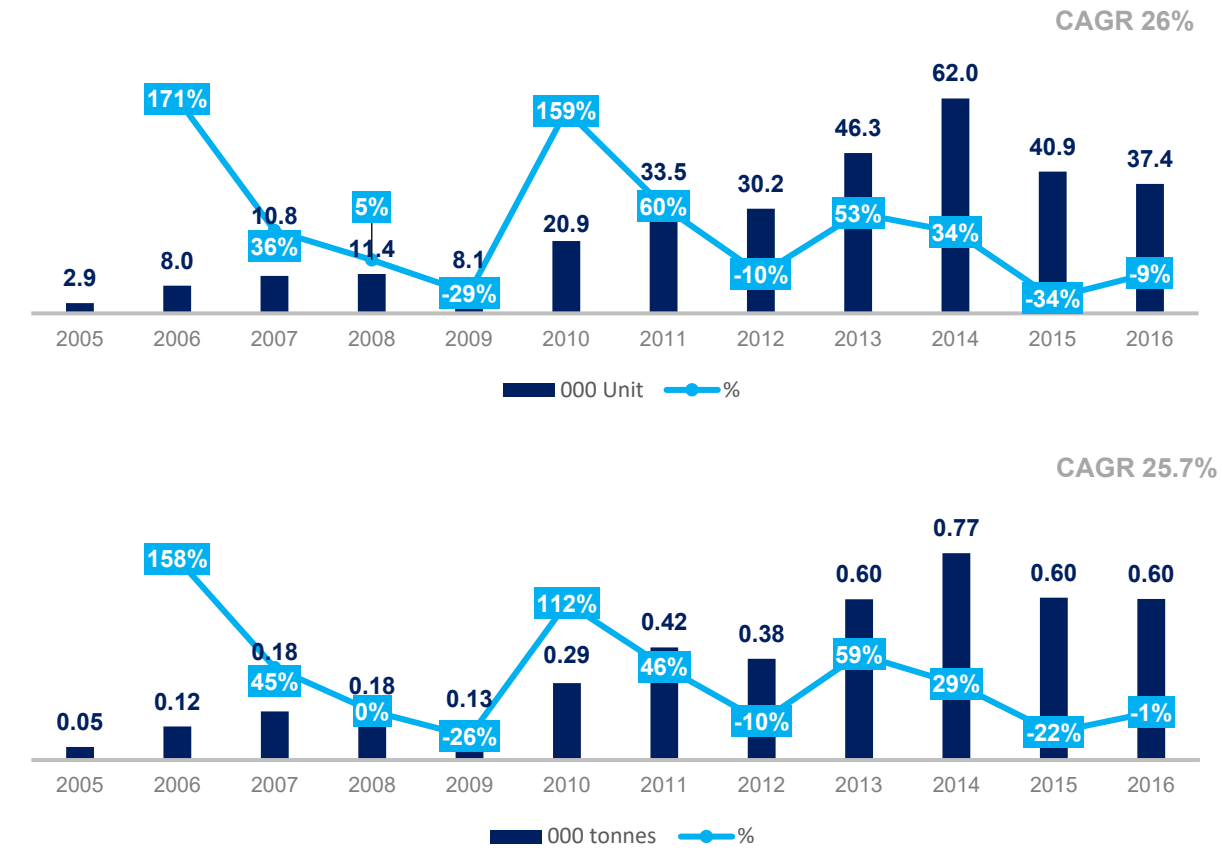
SOURCE: GEOSTAT

Average lifecycle of dishwasher is 6.3 years. The waste generated by dishwashers is increasing by 27% in 5 years' period reaching 65 tonnes in 2016. 25% of households interviewed keep end of life dishwashers at home, the other 24% are throwing in the household garbage, about 30% are giving away or selling and 16% are giving it to the scrap collectors.Ovens

[18] Numbers presented by years is not cumulative and shows the volume of e-waste for selected category per year.

Ovens as dishwashers are having a small stake in household appliances; however, the imported quantities are increasing every year with the average growth rate of 26%. In 2016, 37,400 ovens were imported.

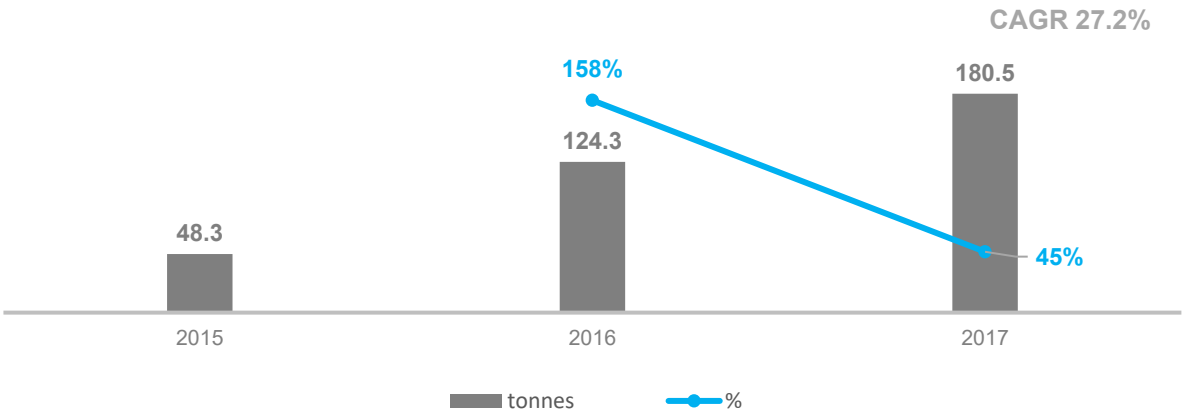
Figure 16 - Oven put on market 2005-2016



SOURCE: GEOSTAT

Average lifecycle of ovens are 9.1 years. Due to the longevity of operations and smaller weight, waste generated by ovens are less significant and equaled to 180 tonnes in 2016.

Figure 17 – Waste generated by oven (tonnes), 2015-2017[19]



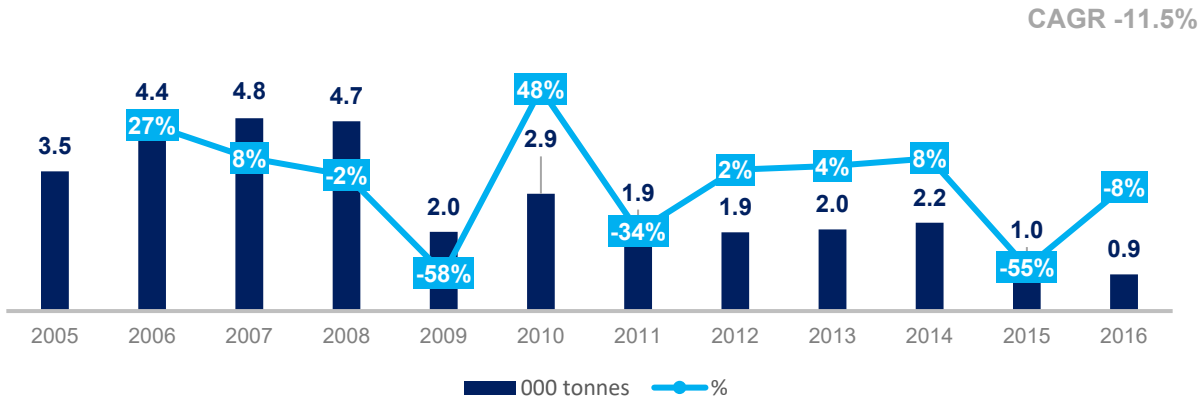
SOURCE: GEOSTAT

There is no clear behavior towards disposal of ovens. 24% of respondents state that they store end of life ovens at home. The other 24% says they are giving it away. 25% is submitting it to the scrap collectors and the rest 21% is throwing it away in household waste.

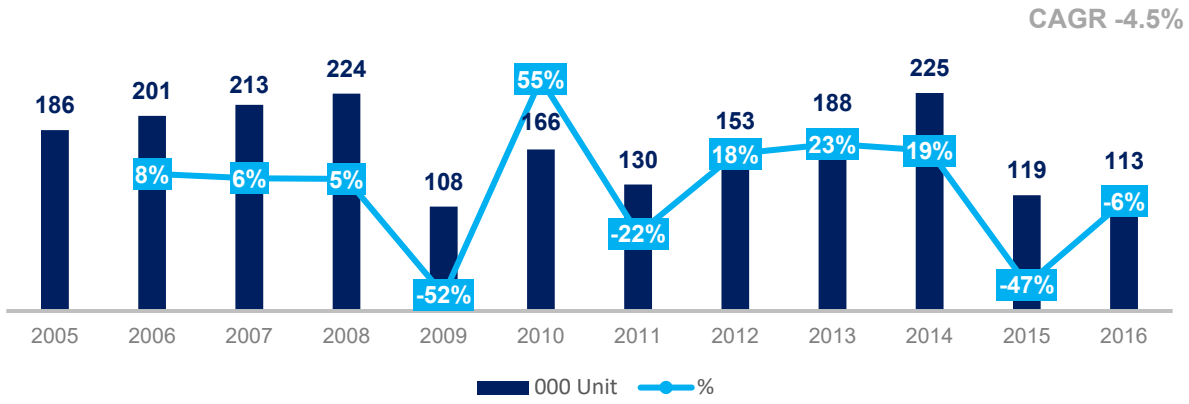
Television

Imports of TVs are falling down showing on average by 4.5%, reaching 155 thousand units in 2016. Currency devaluation has had a major effect on import of television dropping down from 225 thousand units in 2014 to 119 thousand units in 2015. Market for TVs is still on a downturn shrinking by 6% in 2016. Industry experts state that fair share of TV's has been taken by laptops and mobile phones which incorporate TV functions and make it more convenient for the user to have everything they need in one device.

Figure 18 - TV put on the market 2005-2016



[19] Numbers presented by years is not cumulative and shows the volume of e-waste for selected category per year.

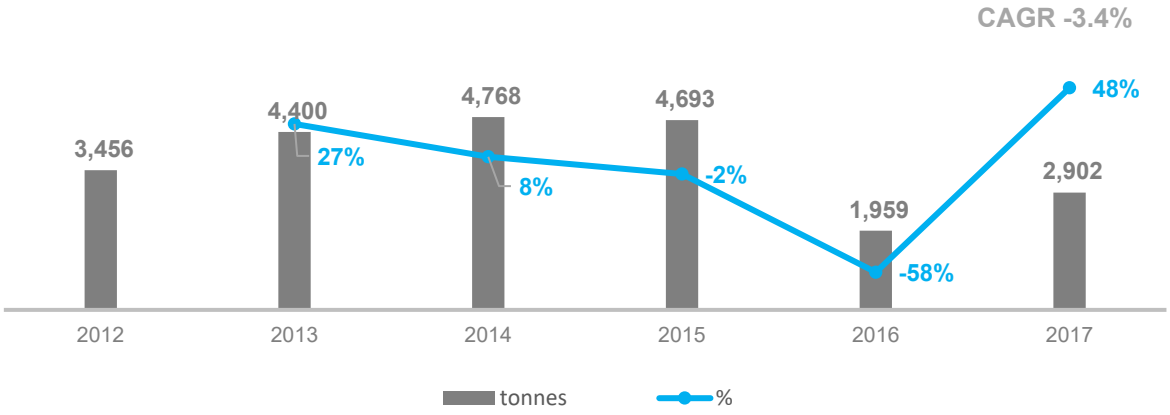


SOURCE: GEOSTAT

Number of TV's per 1000 inhabitant is also dropping from 48 units in 2010 to 33 units in 2016. Average lifecycle of TV's is approximately 10.6 years.

Household survey revealed that almost half of the consumers change TV's despite the fact that it is still working. As explained by industry experts, moral obsolescence plays a significant role in this behavior. It is also noteworthy that TV's together with mobile phones and notebooks are the most commonly stored items - 33% of households store end of life TV's at home.

Figure 19 – Waste generated by TV (tonnes), 2012-2017[20]



SOURCE: GEOSTAT

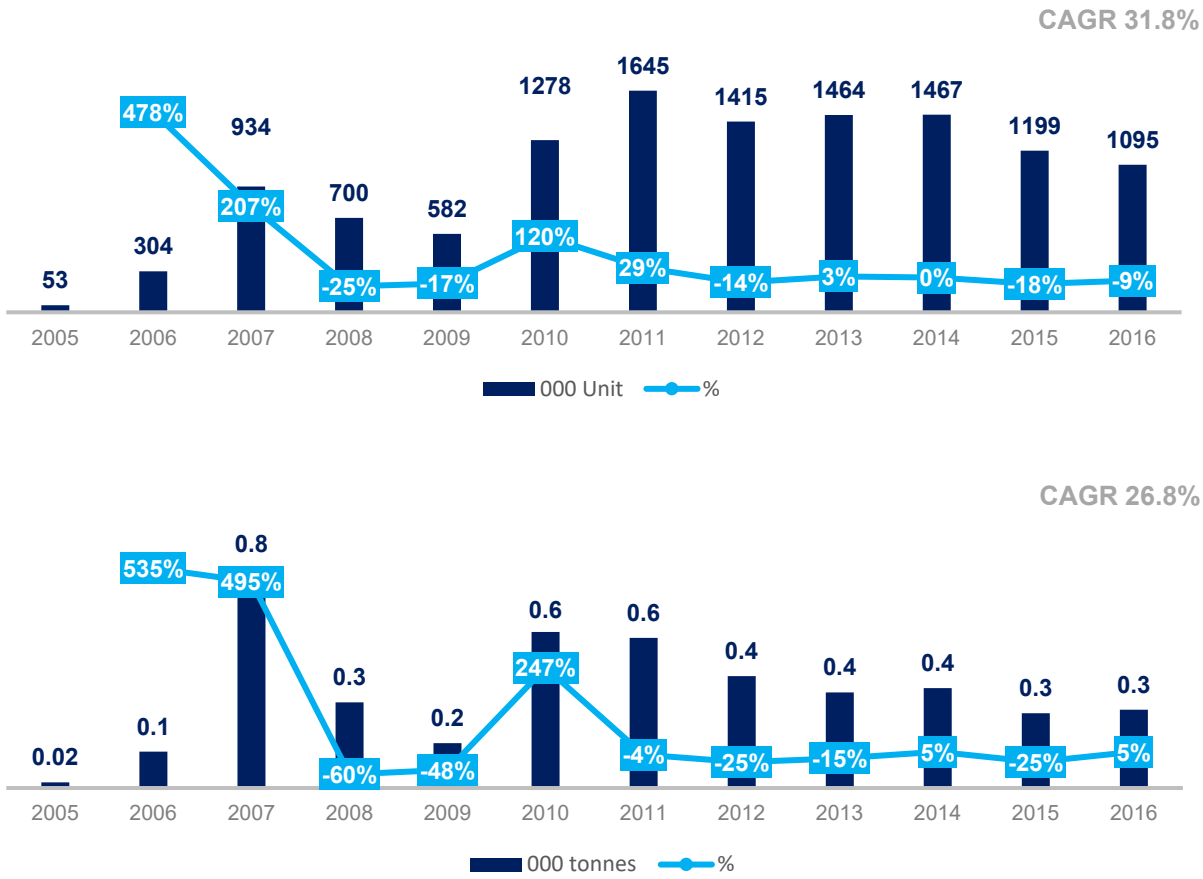
As the number of TV sales decrease so are the waste generated by TV's. Decrease in the weight of TV's is also another factor of negative CAGR -3.4% for the years 2012-2017.

[20] Numbers presented by years is not cumulative and shows the volume of e-waste for selected category per year.

Mobile Phone

Market for mobile phones is also volatile as it is totally import dependent and currency fluctuations are having a significant influence on it. Besides the volatility it shows a growing trend reaching 1,095 thousand units in 2016 with the average growth rate of 32% from 2005 to 2016.

Figure 20 - Mobile phone put on the market 2005-2016

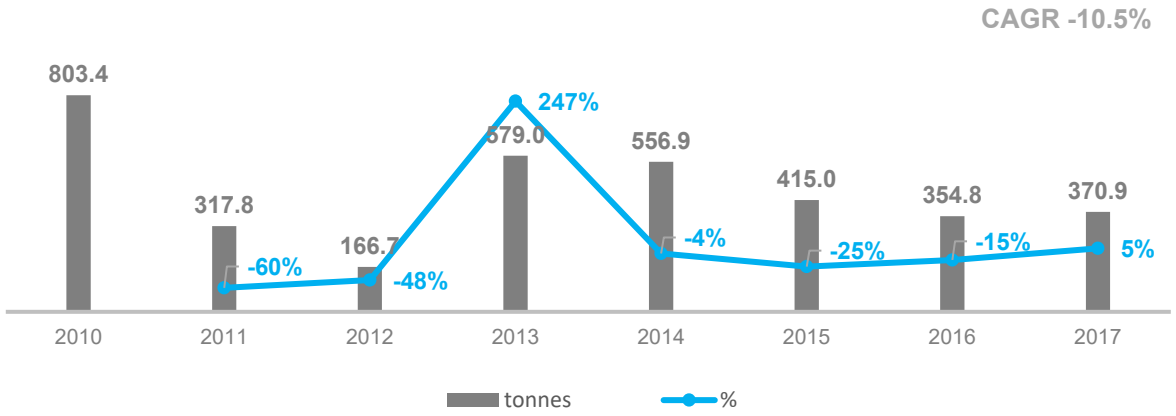


SOURCE: GEOSTAT

The average lifecycle of mobile phones in Georgia is approximately 4.1 years. Almost half of the respondents change mobile phones while the old ones are still working and most of the people (40%) store end of life mobile phones at home. Another widespread behavior is giveaway of the old phones. According to household survey, 33% of respondent's handout used phones to other household members or friends.

According to the Georgia's National Communications Commission, number of active SIM Cards in 2016 counted 5.5 million, which is 1.5 active SIM card per inhabitant, while this figure accounted to 1.1 in 2010. This upward trend is expected to continue in the future.

Figure 21 – Waste generated by mobile phone (tonnes), 2010-2017[21]



SOURCE: GEOSTAT

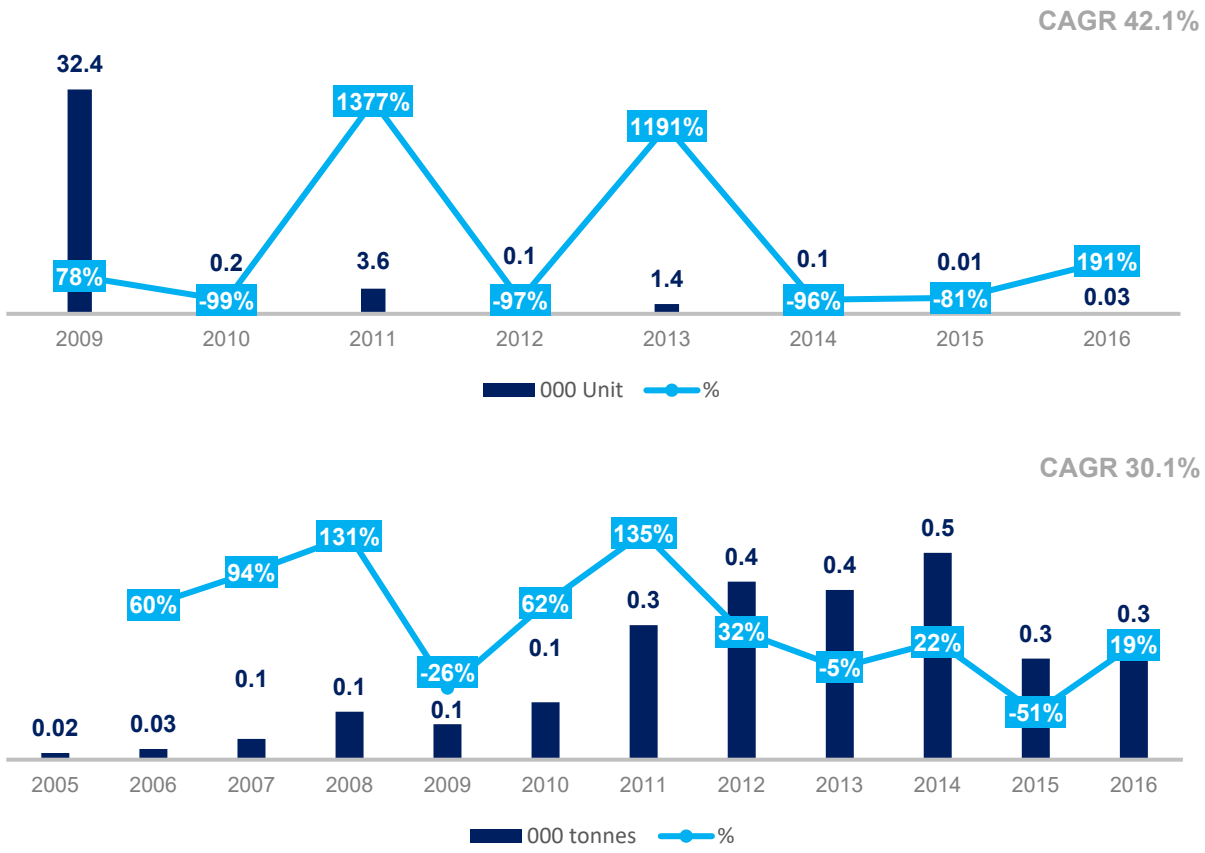
The waste generated by mobile phones are decreasing in terms of volume but increasing by number of units. Decrease in volume is mainly attributed to diminishing weight of mobile phones. In terms of units, 934,000 mobile phones reached end of life in 2010, while the number of phones turning to waste is 57% larger in 2017, reaching 1,467,000 units. As the new technology advances and devices are getting lighter the volume of mobile phones is not expected to increase drastically, besides the fact that the demand for mobile phones is expected to grow.

Computers

Number of portable computers (laptops and tablets) are increasing rapidly with an impressive 42% CAGR, reaching 156,000 of units in 2016. The share of tablets in the category is minor and according to industry experts, it will continue to decline in the future, as product is losing popularity. Main importers of portable devices are China, Netherlands and United Arab Emirates.

Figure 22 - Portable data processing machine put on the market 2005-2016

[21] Numbers presented by years is not cumulative and shows the volume of e-waste for selected category per year.

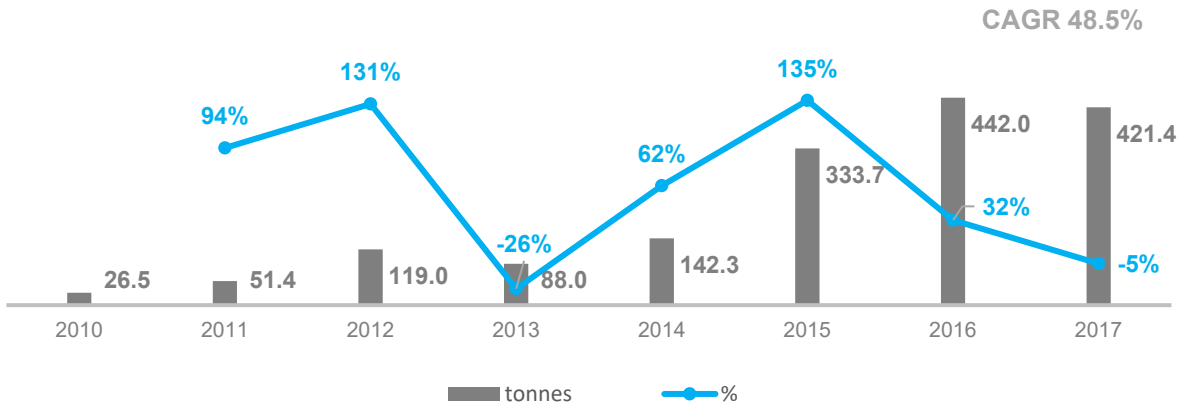


SOURCE: GEOSTAT

The average lifecycle of tablets is 3.5 years, less than other portable devices like laptops that reaches the end of life in 5 years on average. Approximately 40% of households store end of life products at home. Waste generated by portable devices is expected to rise, as the consumption of portable devices will increase over time.

Figure 23 – Waste generated by portable data processing machine (tonnes), 2012-2017[22]

[22] Numbers presented by years is not cumulative and shows the volume of e-waste for selected category per year.

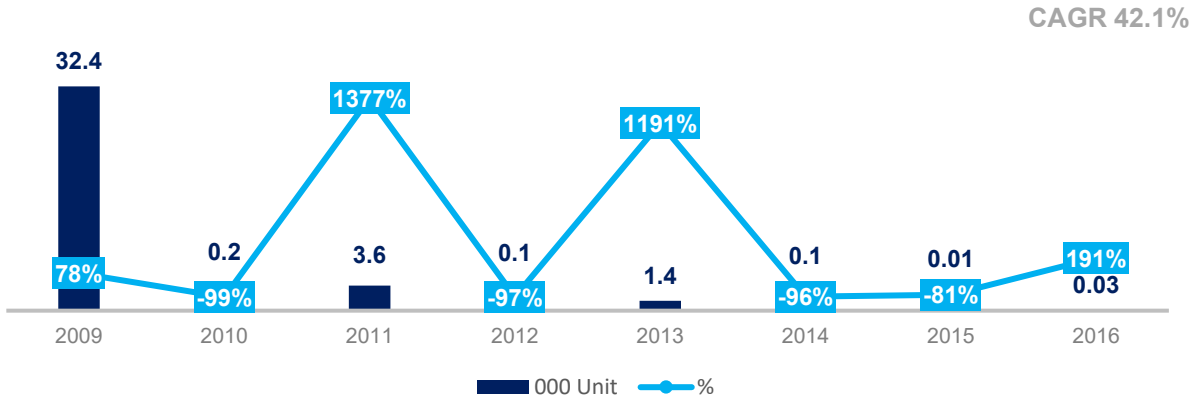


SOURCE: GEOSTAT

CRT Monitors

Import of CRT monitors is as low as 30 items in 2016. Quantity of CRT monitors has declined dramatically after 2009 falling from 32,400 units to 200 units in 2010. Two main reasons for declining trend are customer's behavior of switching from desktop computers to portable devices and establishment of assembly lines locally. According to industry experts, there are more than 200 small assembly lines in Georgia producing approximately 10,000 units of computers annually including tablets, laptops and desktop computers.

Figure 24 – CRT monitors imported (tonnes), 2012-2017



SOURCE: GEOSTAT

FORECAST

This section provides market forecasts for selected electrical and electronic equipment, analyzing EEE market potential for the sales growth in the period of 2017 - 2027. It also describes the methodology and factors used in developing the forecasting model. Each product category is analyzed separately and then aggregated in e-waste for selected products.

Methodology and Approach

Based on the research, we identified the key factors, which determine the future growth or decline. Forecasts are based on the market patterns, described in the previous sections of the report along with other factors which we believe will influence the long-term market trends in consumption of EEE:

- **GDP growth** – GDP is one of the main economic factor affecting the whole economic output and production of the country, as well as consumption patterns of goods and services. Therefore, considering GDP growth pattern and future estimates is undoubtedly important. GDP growth rate has slowed down in the last two years in Georgia reaching 2.7% in 2016. It started to increase in 2017, reaching 4.9% growth rate (I and II quarters 'average). Based on the World Bank and EBRD forecasts, GDP growth rate is expected to increase for the following years reaching 4% in 2018 and 4.5% in 2019.
- **National Income** – the nominal national income growth has decreased from 7% to 4% from 2015 to 2016. Besides, national currency depreciation towards USD reached 29% in 2015 and continues to increase annually, reaching 4% and 5% growth in 2016 and 2017 (10 months' average) respectively. Currency devaluation had a significant impact on the cost structure of the economy, because loan portfolio is highly dollarized in Georgia. Although no further dramatic currency devaluation is foreseen, we are considering very conservative forecasts regarding the next years' economy growth rate in the country, thus we estimate around 5% average growth rate of national income for the next five years.
- **Population** – population in Georgia is not increasing on the contrary, it has shown a decline of -0.1% in 2017. However, number of visitors is increasing which will help to drive EEE market growth, as hospitality sector is one of the active users of EEE. Georgia received circa 6.3 million foreign visitors in 2016 which is 7.8% higher compared to 2015 year. The growth is eminent in 2017, by the results of 10 months' period Georgia received 6.4 million visitors, which is 19% higher than the last years' figure (same 10 months' in 2016). Further growth is expected by 10% year to year. The growth will be triggered by the launch of cheap direct flights from European Countries and also by simplified travel procedures with Russia.
- **Price –** EEE sales market is highly competitive and market players are engaged in price competition, which prevents price increase at least more than the inflation rate. Additionally, consumers become more price sensitive, due to increased variety of brands and products; therefore, prices play significant role in the consumption of EEE especially for low and middle income customers.

- **Per capita consumption** – based on the regional data, per capita consumption is one of the lowest compared to other European countries. Low per capita consumption indicates that the market is less saturated and there is a room for further growth, especially in rural regions.
- **Changing lifestyle** – in general, growing economy results in the improving quality of life. On the other hand, improving life quality means that people can afford higher quality of products than they used to by buying more quality products. In addition, economic development stimulates higher employment and income, which encourages consumption of non-essential products like dishwashers and AC's.
- **Product innovation and moral obsolescence** – New technologies are developing rapidly offering new functionalities to existing products and introducing totally new devices on the market, which affects consumption level positively. Tough competition on the market and changing taste of the customers over time force producers to develop new functionalities and design of the product to maintain or gain market share. Drastic changes in product design and functionality causes moral obsolescence of products and incentivizes consumers to switch to new technologies.
- **Increased product efficiency –** technology producers constantly strive to maximize the benefits and efficiency that consumers get from their products. Therefore, they try to produce devices that are smaller in size and weight and carry variety of functions into one device. Overall, technology advancements, lead to smaller and multifunctional devices, which will generate lower e-waste volumes in the future.
- **Decreasing lifespan of EEE –** Average lifecycle of EEE is decreasing over years, which also stimulates EEE sales. According to German Federal Environment Agency, lifecycle of large household appliances decreased from 14.1 to 13 years from 2004 to 2013. Noticeable decline was apparent with devices that had to be replaced in five years period due to defect. This figure went up from 3.5% in 2004 to 8.3% in 2012.[23]

The table below summarizes all factors discussed above, shows actual, and expected values of each criterion. Based on these assumptions we developed forecasts for EEE market growth, which is subdivided by products.

[23] https://www.umweltbundesamt.de/sites/default/files/medien/378/publikationen/texte_10_2015_einfluss_der_nutzungsdauer_von_produkten_auf_ihre_umwelt_obsoleszenz_17.3.2015.pdf

Figure 25 - Summary Table of Forecasting Factors

Quantitative

Factors	Unit	Value	Description	Future Trend 2017-2021
National Income	CAGR 2009-2016	10.30%	National Income Nominal Growth is decreasing	**8.50%**
Population	CAGR 2009-2014	0.47%	Population is increasing at slow rate	**0.40%**
Foreign Visitors	CAGR 2009-2016	22.92%	Foreign Visitors growing at high rate	**10.0%**
Per Capita Consumption	Kg Per Person, 2012	9.9	EEE consumption is very low compared to EU countries	**).4**

Qualitative

Factors	Description	Future Trend 2017-2021
Product Innovation	Consumers are getting more demanding and selective toward the products.	Market players should constantly update their products to the consumer needs in order to maintain the market share
Changing Lifestyle	People are getting to use more Electronic equipment in order to maximize the efficiency and save time	Changed behavior will increase the consumption of household as well as office appliances
Price	Tough Competition at consumer electronics market will put prices under pressure, encouraging consumption of electrical and electronic devices.	Prices are expected to fall down on consumer electronics

SOURCE: PMO Analysis

Georgian Consumer Appliance Market Forecasts (for selected 9 categories)

In the proposed forecast model, EEE market projections are mainly based on Compound Annual Growth Rates (CAGR) for each product category. Some adjustments were made to the certain categories where data was unsettled and characterized with volatility so that continuous trend was not visible.

As we already discussed, the EEE market has been growing in terms of volume by 6.7% over the period 2005-2016. Based on our projection, EEE market will continue growth on average by 12.5% for the next ten years. Growth will be more eminent in regions were market is still immature. As for the price, it is expected to go down as technology advances.

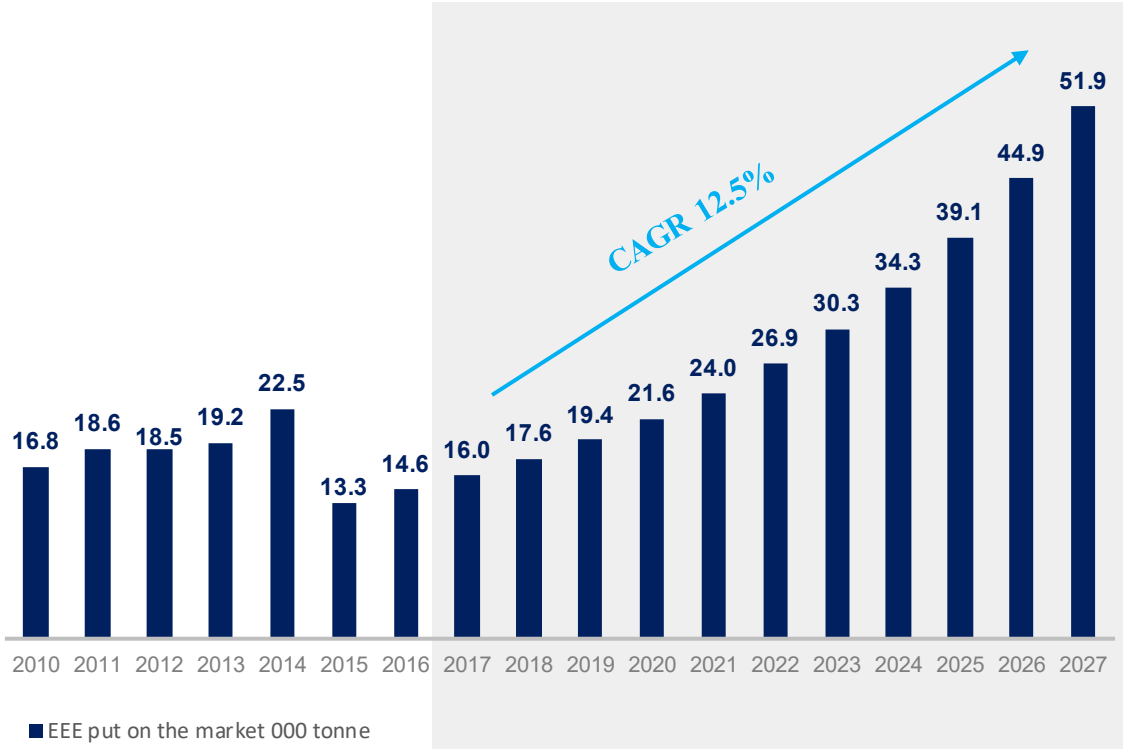
The table below summarizes past and future trends of selected eight EEE market showing consumption volume and growth rates, both per product category and in total.

Figure 26 – EEE put on the market actual and forecasted data 2016 - 2027 (000 tonnes)

Equipment Type	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	CAGR 2017-2027
Fridge	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0	4.3	4.5	4.8	5.1	**6.2%**
Air Conditioner	2.9	3.1	3.3	3.5	3.8	4.0	4.3	4.6	4.9	5.2	5.6	6.0	**6.8%**
Washing Machine	6.1	6.7	7.3	8.1	8.9	9.8	10.7	11.8	13.0	14.3	15.7	17.3	**10%**
Television	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	**0%**
Mobile Phone	0.3	0.37	0.47	0.59	0.75	0.96	1.21	1.54	1.95	2.47	3.14	3.98	**26.8%**
Laptop/Tablets	0.3	0.39	0.51	0.66	0.86	1.11	1.45	1.88	2.45	3.19	4.15	5.39	**30.1%**
CRT Monitors	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	**0%**
Ovens	0.6	0.75	0.94	1.19	1.49	1.88	2.36	2.96	3.73	4.68	5.89	7.40	**25.7%**
Dishwasher	0.4	0.46	0.59	0.75	0.96	1.22	1.55	1.98	2.52	3.22	4.10	5.23	**27.5%**
Total	**14.6**	**16.03**	**17.62**	**19.44**	**21.55**	**24.01**	**26.89**	**30.29**	**34.32**	**39.13**	**44.90**	**51.89**	**12.5%**

The charts below show our projection model results, where EEE market volume is reaching 52 thousand tonnes in 2027, which rises per capita consumption from 3.9 kg in 2016 to 13.9 kg in 2027. EEE market growth is expected to be 12.5% in 2017-2027 period.

Figure 27 – EEE put on the market actual and forecasted data 2010 - 2027



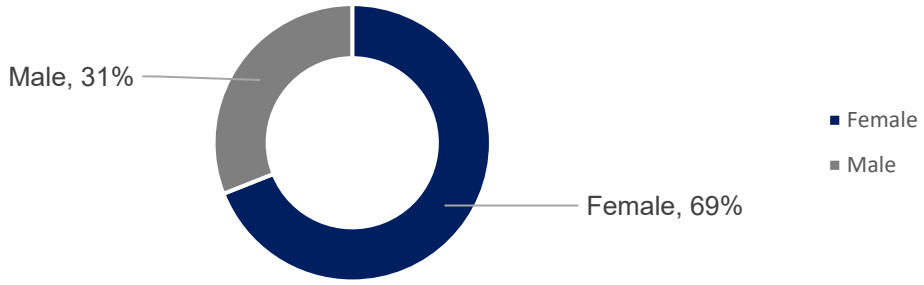
SOURCE: PMO Analysis

Annex 1 - Household Survey Results

Charts below represent the results of household survey conducted online with 378 respondents across Georgia, including people from regions and rural settlements. Survey was distributed via online sources including social network (Facebook) and e-mail, by different organizations: PMO, Ministry of Environment, Georgian Environmental Outlook (GEO), CENN and encompassed various groups from capital and regions of Georgia. Duration of Survey was one month.

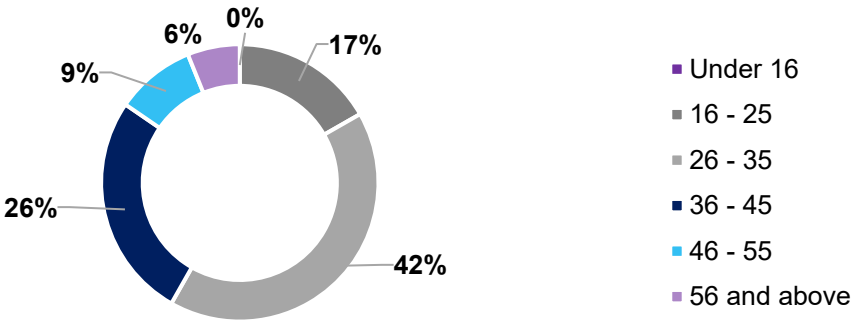
Survey covered all age categories, but 26-35 age group had most representation (42%). In terms of gender, female respondents were dominating the pool.

Figure 28 – Gender Distribution



SOURCE: Household Survey, 2017

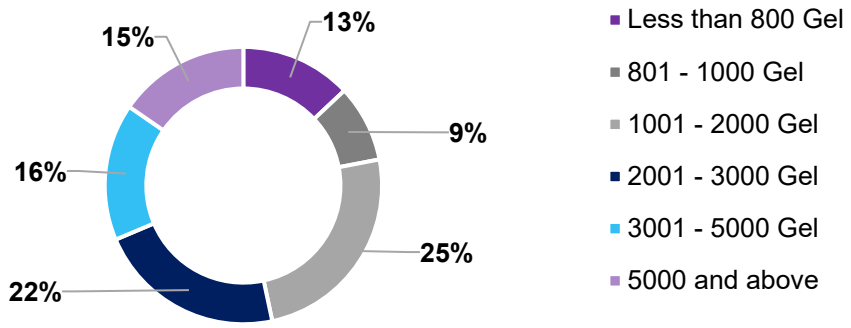
Figure 29 – Age distribution by categories



SOURCE: Household Survey, 2017

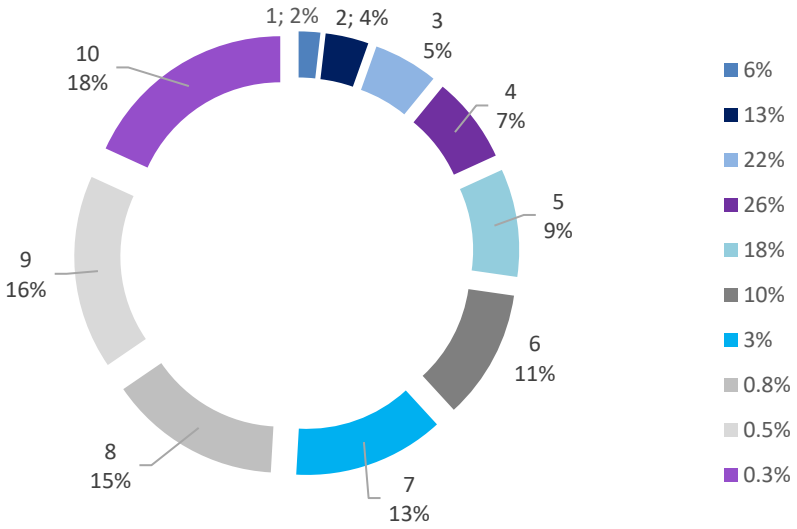
Survey had a good representation of all income groups and household sizes:

Figure 30 – Household Income



SOURCE: Household Survey, 2017

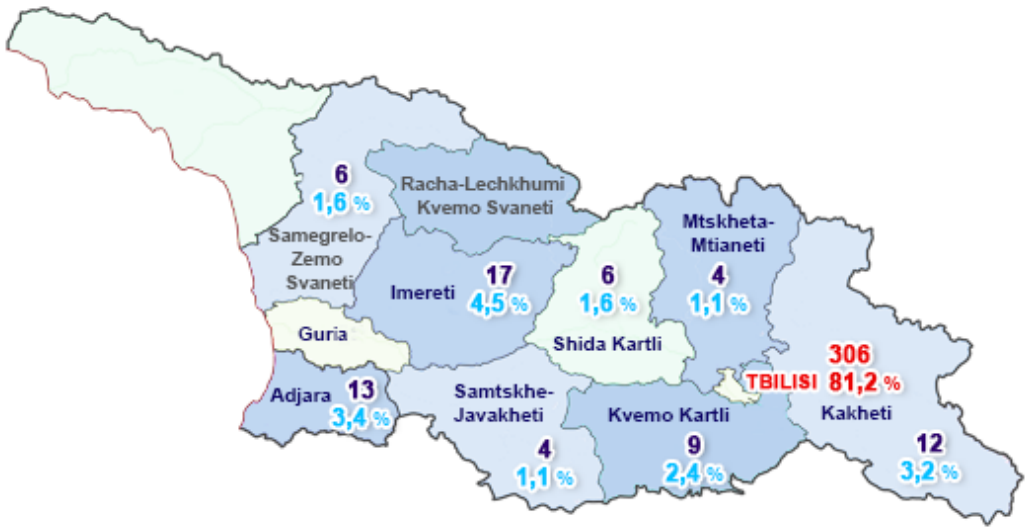
Figure 31 – Number of households



SOURCE: Household Survey, 2017

Survey covered different regions of Georgia but was dominated by capital Tbilisi (81%). Survey also covered rural areas with 6.9% (26) of responses.

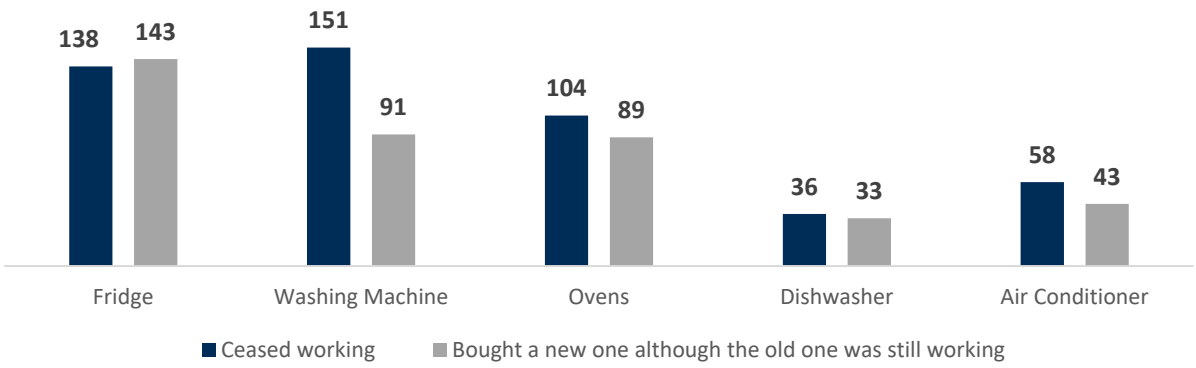
Figure 32 – Regional distribution of respondents

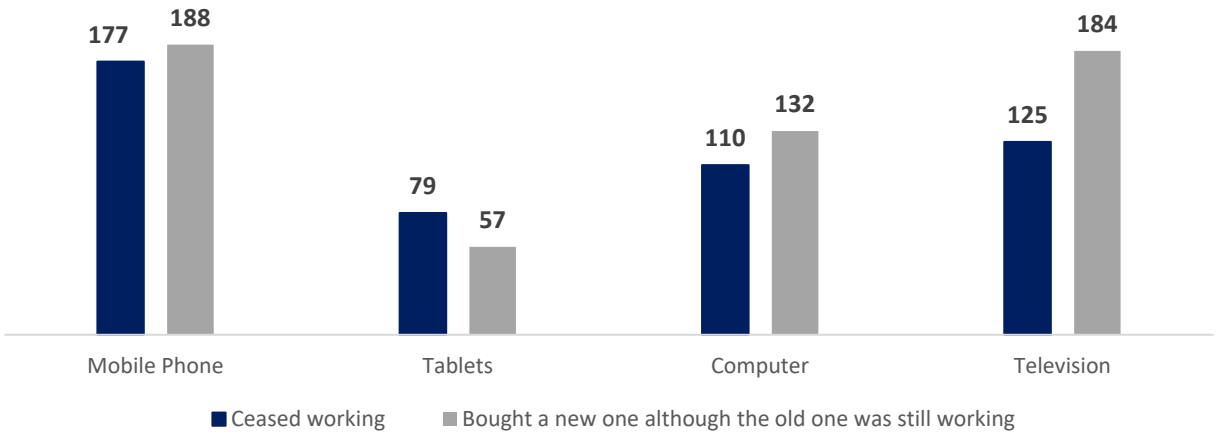


SOURCE: Household Survey, 2017

Behavior in changing devices varies by product. Mostly household appliances are changed when they cease working while office appliances are changes before they reach end of life.

Figure 33 – Factors for changing the device

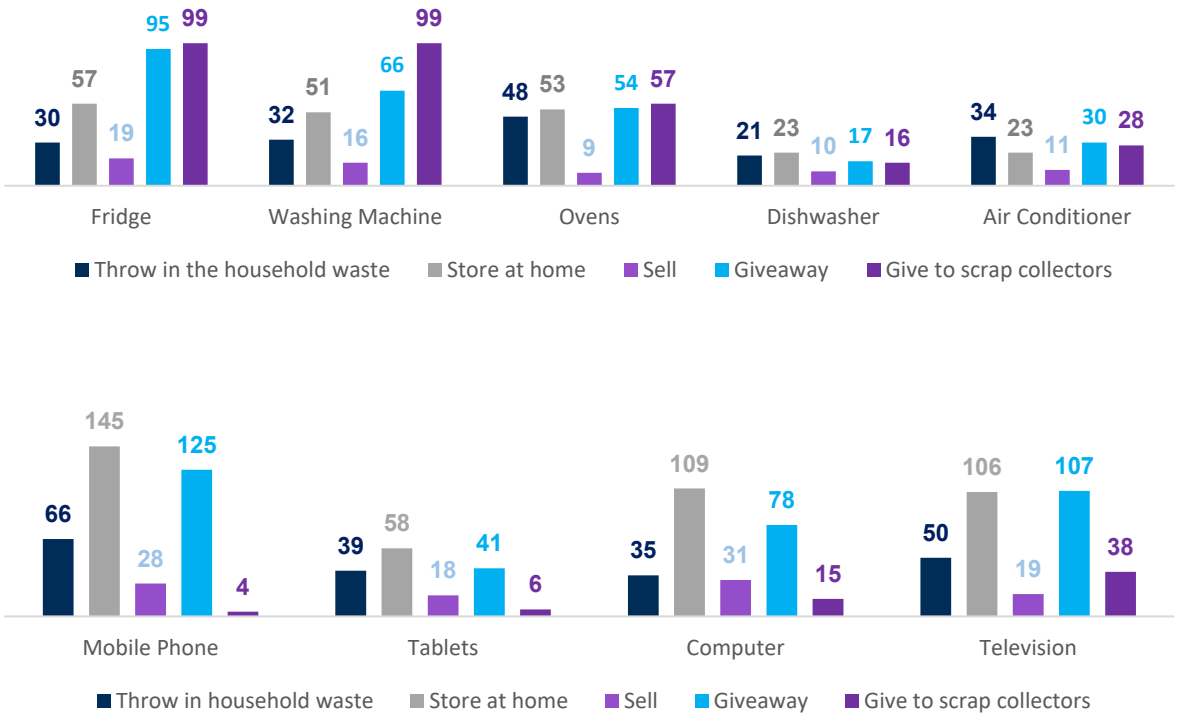




SOURCE: Household Survey, 2017

Household appliances are most commonly passed to scrap collectors or given away to relatives and friends. In terms of office appliances, respondents most frequently store them at home or give it as a gift. The most unpopular form of disposal in both categories is selling of old devices.

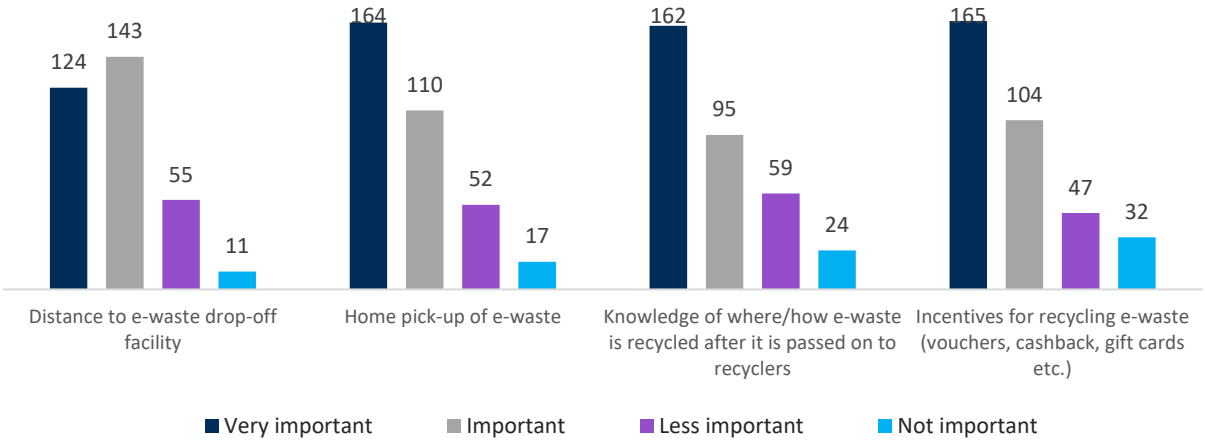
Figure 34 – Disposal methods per device



SOURCE: Household Survey, 2017

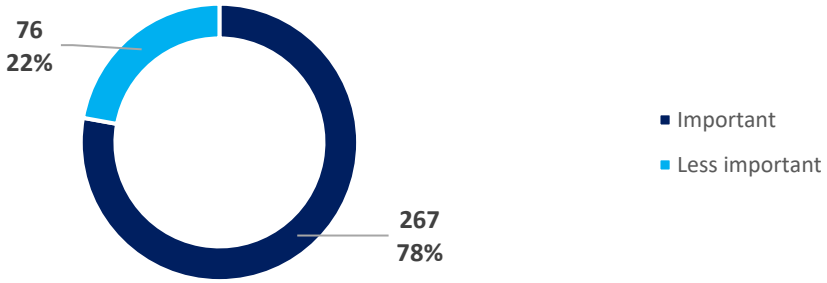
Households recon all of the four components almost equally important. Home-pick up is slightly outpacing other factors with 274 positive responses followed by giving incentives to households to separate the waste (269)

Figure 35 – Factors for e-waste separation by importance



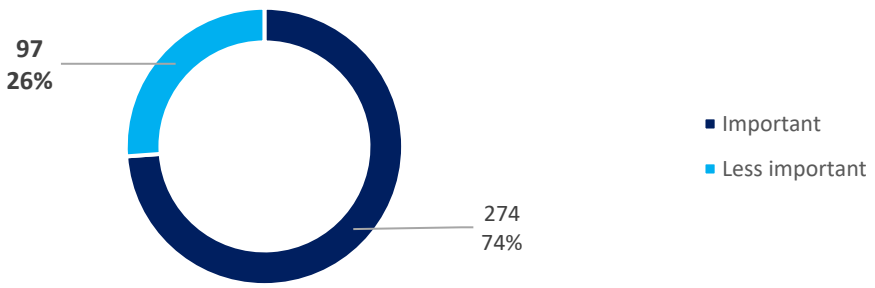
SOURCE: Household Survey, 2017

Figure 36 – Distance to e-waste drop-off facility



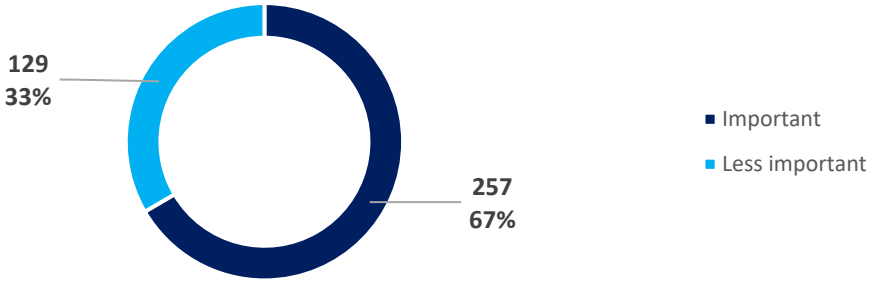
SOURCE: Household Survey, 2017

Figure 37 – Home pick-up of e-waste



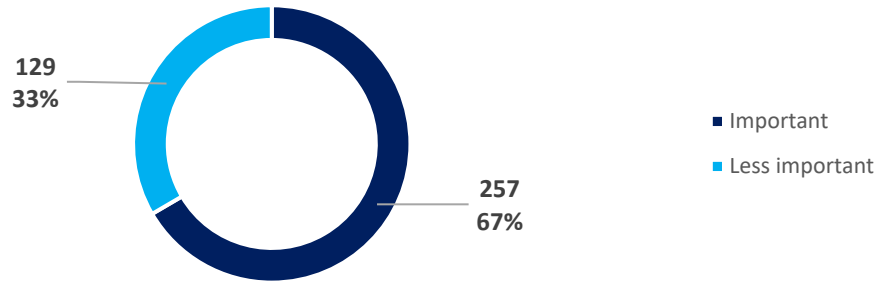
SOURCE: Household Survey, 2017

Figure 38 – Knowledge of where/how e-waste is recycled after it is passed on to recyclers



SOURCE: Household Survey, 2017

Figure 39 – Incentives for recycling (vouchers, gift cards, cashback etc.)



SOURCE: Household Survey, 2017

Annex 2 – List of People Met

Company Name	Respondent Name	Position	Contact Information
Distributors/Resellers			
Alta Okay	Zurab Tabidze	Commercial Director	Tel: 599562401 Email: z.tabidze@alta.com.ge
Pcshop.ge (UGT daughter company)	Zurab Khorguashvili	Director	Tel: +99559909310 Email: zurab.khorguashvili@pcshop.ge
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