Preliminary and brief initial assessment of electronic waste for Central Asia focusing on Kyrgyzstan and Tajikistan

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Introduction

This study continues the work that started within the frame of the "Regional Workshop on Capacity Building for the Environmentally Sound Management of Electrical and Electronic Equipment Waste through Regional Cooperation between Eastern Europe and Central Asia" organized and conducted with the support provided by the Secretariat of the Basel Convention in July 2016 in the Kyrgyz Republic. It was decided to implement this study after the discussion of the problems that exist in the countries of Central Asia in the field of electronic waste management. This project was funded by the European Union. The project is a part of the technical assistance of the Secretariat of the Basel Convention and is implemented by PA "Independent Ecological Expertise".

In Central Asian countries, the system of electronic waste management began to develop recently. A real understanding of the need to introduce and develop a proper management system for electrical and electronic equipment waste has emerged in the region, which is a positive factor. Currently, Kazakhstan and Uzbekistan have already adopted regulatory legal acts aimed at regulating electronic waste, which in turn has laid the foundation for recycling industry development in these countries. Kyrgyzstan, Tajikistan and Turkmenistan are undertaking various initiatives to introduce and promote their electronic waste management systems drawing on international experience and current practices applied by neighboring countries.

World experience shows that accounting of waste quantity and assessing its composition is the most important stage in formation of an effective management system for any type of waste. Since this allows to estimate the costs related to proper collection, transportation and environmentally sound processing, including creation of a market for secondary material resources, as well as ensure stimulation of their use. This in turn reduces threats to both the environment and human health. While studying various sources of the information it was found that figures on the amount of generated electrical and electronic equipment (EEE) waste were different and the discrepancies were caused first of all by the lack of a clear integrated system for accounting of the amount of waste in all the countries studied.

In this view, an attempt was made in this study to compile the data available for Central Asian countries (CA) and to conduct preliminary assessment of electronic waste generation using the example of some groups of goods that are potential electronic waste. In addition, in order to understand current framework conditions in the countries, a brief review of current legislation in each country was made, stakeholder assessment in Kyrgyzstan and Tajikistan was conducted along with environmental and socio-economic consequences.

This study was prepared by public association "The Independent Environmental Expertise" (the Kyrgyz Republic) and public environmental organization "Civil Initiatives Support Fund" (the Republic of Tajikistan, Dastgiri-Center).

Based on the recommendation of the Secretariat of the Basel Convention, the group of experts was guided in its work by a publication developed under the African project of the Basel Convention Secretariat "E-Waste Assessment Methodology. Training and Reference Manual" as of 2012.

We hope that this work will lay the foundation to further large-scale work in the field of electronic waste assessment in the region and will help to unite efforts in the international cooperation in development of effective electronic waste management system.

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1 Identification of the problems

Electronic waste management is intended to perform various tasks. Because waste while being a subject of control and state regulation has features determined by two fundamentally different properties. On the one hand, waste is a source of negative impact on human health and the environment, on the other hand, it is a source of conditionally "renewable" material and fuel and energy resources, which are called secondary material resources.

In order to mitigate significant harmful impacts of electronic waste on the ecosystem, a number of civilized countries, on the one hand, restrict the use of various substances in these products, and on the other hand they organize safe processing of electronic waste with the support of the relevant legislative framework.

Currently, none of the Central Asian countries has well-formed and efficiently functioning electronic waste management system. But there is a need and opportunities for formulating and implementing common approaches to processing this kind of waste both at the level of the individual countries and at the regional level.

As the world practice shows, introduction and development of electrical and electronic equipment waste management system requires a comprehensive structured approach that is based on the relevant legislation and developed infrastructure.

In order to define a strategy and implement the most appropriate electronic waste management system, it is necessary to understand current framework conditions at the local, national or regional level. Assessment of electronic waste allows obtaining the necessary knowledge about current situation and the available capacity for really integrated approach.

In this view, the initiative to carry out this study is determined by the following challenges present in the countries of the region in question:

- different degrees of development and implementation of regulatory and legal framework;
- different financial capacity;
- lack of reliable statistics regarding generation and processing of waste to develop economic forecasts and etc.;
- there is no infrastructure or underdeveloped infrastructure for collection and processing of waste and different levels of their organization;
- a large share of waste processing is in the shade, at that, processing is not complex.

Based on the scale and growth rates of the EEE market, the sharp increase in EEE waste in CA states and presence of the above problems, there is a need to assess current capacity in the countries of the region - understanding of current situation in the field of legislation, identification of the participants of the process and an inventory analysis of e-waste itself and its possible negative impact on the environment and socio-economic consequences.

This study is just an initial attempt to examine and conduct preliminary assessment of current situation in the countries of Central Asia, since it is based mainly on the data available at the time when this work was performed. When assessing the stakeholders, only the results of surveys in two countries (Kyrgyzstan and Tajikistan) were used; when assessing mass flows, four groups of goods were selected, which are the most common and in relation to which it was possible to collect the most detailed data.

2 Objectives of assessment

Compilation of the data available in the region to obtain the required knowledge of current situation and capacity in Central Asian countries in the field of electrical and electronic equipment waste management, and approbation of assessment methods presented in the manual "Electronic

Waste Assessment Methodology. Teaching and reference manual" for further large-scale work to be performed in the future.

3 Methods

In the course of the study the methods described in "Electronic Waste Assessment Methodology. Teaching and reference manual" developed by EMPA have been used as a basis. The methodology was finalized as part of the project entitled "Building local capacity to address the flow of e-wastes and electrical and electronic products destined for reuse in selected African countries and augment the sustainable management of resources through the recovery of materials in e-wastes" (the Basel Convention, UNEP, 2012).

In accordance with the above-mentioned manual, at the first stage, **analysis of policies and legislation** of CA countries was carried out. "Adviser" legal database and "Toktom" information and legal system were used to review normative legal acts effective in Kazakhstan, Kyrgyzstan, Turkmenistan and Uzbekistan. To review the legislative acts of Tajikistan the relevant databases were used that were available in the Republic.

The next stage - **stakeholder assessment** was carried out only for Kyrgyzstan and Tajikistan and was based on the results of surveys conducted in these countries among importers and distributors of electronic equipment, regular consumers, as well as repairers and processors of electronic waste of this group of goods. The questionnaires from the manual were used for the survey. Completion of the questionnaires and consideration of the opinions of public and educational institutions were carried out through electronic mailings. Interviews with distributors, repairmen and waste collectors were conducted directly in repair shops, places of electronic waste collection. In addition, observations were made on handling electronic devices in the points of their sale, collection and processing, as well as existing informal markets intended for sale of used products. The methods used for questioning and survey are described in paragraph 3.2.

Mass flows assessment is the third stage of the study. At this stage, available data were used from analytical and statistical sources for 4 groups of goods most popular among consumers: refrigerators, computers, mobile phones, mercury lamps. In addition, availability of the information on these types of products: their production, exports and imports in both monetary and quantitative terms (mass per year) was one of the criteria for selecting the above products.

The product groups selected correspond to the categories of the Directive of the European Parliament and the Council of the European Union # 2002/96/EU as of J27, 2003 "On electrical and electronic equipment waste". Table 1 lists the categories of these goods and their names in accordance with HS Classification[1] and codes of FEACN of the EAEU[2] (see Table 1).

Table 1

Groups of goods selected for the study

[1]HS Classification – classification of goods according to the international harmonized system for description and coding of goods. HS code - Harmonized System code.

[2] In the EAEU, Foreign Economic Activity Commodity Nomenclature (FEACN) is applied, which almost completely coincides with HS.

Groups of goods in accordance with the categories of the EU Directive # 2002/96/EU	Code of a group of goods according to HS Classification	Group of goods description according to HS Classification	Group of goods description according to FEACN of the EAEU
1. Large household appliances –	841810	Combined refrigerator-freezers, with separate external doors	Combined refrigerator-freezers, with separate external doors
3. IT and telecommunications equipment –	847141	Data-processing machines, automatic, comprising in the same housing at least a central processing	Computers containing in one case at least central data processing unit and input and output device combined or not
3. IT and telecommunications equipment –	851712	Telephones for cellular networks "mobile telephones" or for other wireless networks	Telephone sets for cellular communication networks or other wireless communication networks
5. Lighting equipment –	853932	Mercury or sodium vapour lamps; metal halide lamps	Mercury or sodium lamps; metal halide lamps

Methods used for this type of assessment are described in detail in paragraph 3.3.

The fourth stage - **assessment of impact on the environment and human health**
At this stage, well-known data were used regarding negative impact of hazardous components of electronic waste with a focus on the activities of illegal processing sector, which is developed in the countries in question, and thus possible environmental and health impacts of illegal sector were identified. In addition, calculation was made for each component of waste of products selected for the study.

3.1 Obtaining country data

For Kazakhstan, Turkmenistan and Uzbekistan, the analysis was carried out only based on the data from analytical and statistical sources available in the Internet, including information posted on the TRADE MAP website http://www.trademap.org[3], as well as the legal and information-legal databases available to the NGO "The Independent Environmental Expertise" for countries of the Commonwealth of Independent States.

When working with the data for Kazakhstan, the results of the study "Analysis of the situation in the field of electronic and electrical equipment waste management in the Republic of Kazakhstan" of the UNDP project "Electronic Waste Management" conducted in 2014 by the national expert on analysis of the situation in the field of electronic waste Ms. Yu. Dushkina were actively used.

In Kyrgyzstan and Tajikistan, the analysis was carried out based on the data collected by national experts on the ground from available analytical sources, including country statistics, legal and information and legal databases and the TRADE MAP website. The results of questionnaires, surveys and meetings held in these countries during stakeholder assessment were also used.

[3] International statistical database on trade indicators in countries. Available online.

Table 2 presents a list of documents, databases, Internet sites that were the main sources of the information in the course of the work.

Table 2

The main sources of the information

http://ewasteguide.info/	Database on sustainable electronic waste management.
http://www.basel.int/	Official website of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.
http://www.trademap.org	Online tool with monthly, quarterly and annual international trade data combined with statistical indicators and information on trading companies
http://www.ecoaccord.org/	Website of the Center for Environment and Sustainable Development.
http://ecoportal.su/wastet.php	Database on component composition of waste
http://ecobatman.ru/othodi_sostav.php	Database of chemical and component composition of waste of hazard class 1-4
http://countrymeters.info	Database of changes in the population and other demographic and social processes in any country in the world.
http://www.cisstat.com/	Interstate Statistical Committee of the Commonwealth of Independent States
Ministries and agencies of the Republic of Kazakhstan	
http://economy.gov.kz/	Ministry of National Economy of the RK
http://stat.gov.kz	Statistics Committee of the Ministry of National Economy of the Republic of Kazakhstan
Ministries and agencies of the Kyrgyz Republic	
http://mineconom.gov.kg	Ministry of Economy of the KR
http://www.customs.gov.kg	State Customs Service under the Government of the Kyrgyz Republic
http://stat.kg/ru/	National Statistics Committee of the Kyrgyz Republic
Ministries and agencies of the Republic of Tajikistan	
http://medt.tj	Ministry of Economic Development and Trade of the Republic of Tajikistan
http://hifzitabiat.tj/?lang=ru	Committee for Environmental Protection under the Government of the Republic of Tajikistan
http://www.stat.tj	Statistics Agency under the President of the Republic of Tajikistan
www.customs.tj	Customs Service of the Republic of Tajikistan
Ministries and agencies of Turkmenistan	
www.natureprotection.gov.tm	Ministry of Nature Protection of Turkmenistan
www.stat.gov.tm	State Statistics Committee of Turkmenistan

https://customs.gov.tm	State Customs Service of Turkmenistan
Ministries and agencies of the Republic of Uzbekistan	
http://www.mineconomy.uz/	Ministry of Economy of the Republic of Uzbekistan
www.stat.uz	State Statistics Committee of Uzbekistan

3.2 Questionnaires, surveys and meetings

Collection of basic information was carried out using such methods as questionnaires, surveys, in-depth personal interviews.

The following methods have been applied during the work:

1. Quantitative method

For quantitative study the questionnaires of the Methodology for Electronic Waste Assessment have been used. The survey was conducted in Bishkek, the Kyrgyz Republic and in Dushanbe, the Republic of Tajikistan. The survey covered: importers, distributors, consumers, assemblers and processors of electronic and electrical equipment.

The respondents have been questioned through the Internet mailing list, as well as directly by distribution of questionnaires among interested groups.

2. Qualitative method

Conducting personal meetings and interviews, as well as in-depth interviews with interested groups and individuals.

Meetings with the heads of households, public organizations, employees of state organizations, representatives of non-profit sector, interviews with environmental experts were of great importance.

3.3 Mass flows assessment

For assessment two methods were used: the method of “Market Sales” and the method of “Acquisition and Use”.

1. “Market Sales” method:

With this method, statistical data are used regarding sales volumes of electrical and electronic equipment (EEE) in the domestic market of the country in the past and the average service life of equipment.

The formula for calculating the amount of waste generated according to the method of “Market Sales”:

$$WEEE=N0*(t-Ls)$$
$$N0=N1+N2-N3,$$

where:

N0 - National sales of electrical and electronic equipment of a certain category in a year t;

Ls - The average lifetime of a new product;

N1 - National production of electrical and electronic equipment of a certain category in a year t;

N2 - Import of electrical and electronic equipment of a certain category in a year t;

N3 - Export of electrical and electronic equipment of a certain category in a year t.

The method is used to estimate the volume of waste generation in the current year of 2017, to do so it is necessary to estimate the sales volumes of the equipment in question by extrapolating the estimated service life in the reverse time.

2. "Acquisition and Use" method:

With this method, it is necessary to determine the average number of EEE units of each type in one household and the average service life of this type of EEE. To assess the volume of waste generation of a particular type of EEE, the average number of EEE units in one household should be multiplied by the number of households in the country, multiplied by the average weight of this type of EEE and divided by the average service life of this type of EEE.

The formula for calculating the number of obsolete devices according to the "Acquisition and Use" method:

WEEE per year = m hh r/ Ls,

where:

m - Average weight per device n;

hh - Number of households;

r – Saturation rate of device n per household;

Ls – Average service life of the new device n.

The data related to the level of households' provision with various types of electrical appliances have been taken from the study of the United Nations Environment Program and the Central Asian Regional Environmental Center for 2015 "Assessment of energy consumption of household electrical appliances and the policy on energy efficiency of household appliances in Central Asian countries". The level of households' provision with various types of electrical appliances (the number of units of electrical appliance per 100 households) reflects importance or popularity of various types of household appliances for families, and allows to approximately estimate the demand capacity for various types of household appliances (depending on their size, purpose). Because of the absence of the information regarding the level of provision of households with mercury lamps calculations for this category have not been made.

It should be noted that the available (estimated) data on provision of household appliances are average across countries and do not reflect the differences between urban and rural households.

3.4 Limitations

Since this study is a preliminary assessment of the situation in the field of electronic waste management in countries of Central Asia, the data for assessment from various open sources, both official and non-official have been used. Upon collection of the information in most cases the information was missing, or the information was not available regarding the flows and stocks of electronic and electrical goods throughout their life cycle and the reporting on morphology of the waste. In addition, presence of shadow business related to waste processing makes it difficult to quantify the flow of electronic waste on the ground. In this view, we cannot talk about completeness and accuracy of obtaining data and, therefore, this study shows only general dynamics.

4 Geographical coverage

The geopolitical region of Central Asia is a vast and land-locked territory located in the central part of Eurasia. Despite the lack of clear boundary demarcation, according to the generally accepted view, the region is composed of modern states of Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan. Central Asia with total area of 3 994 400 square km accounts for about 10% of Asian continent representing important geostrategic region on the world map.

The countries of Central Asia differ in terms of their territory size, the population, reserves of natural resources and the level of their economic and human development. The collapse of the Soviet Union led to the loss of economic ties between the republics of the former USSR, which caused a deep economic recession in the countries of the region. Economic reforms, attracting investments and increasing export potential have gradually led to recovery, and then to economic growth in the countries of Central Asia. Economic growth in the region largely depends on commodity focus of the economy and global commodity prices.

4.1 Kazakhstan

Official name is the Republic of Kazakhstan (RK). The total area is 2 724 902 km^2. Astana is the capital city. Almaty is the largest city with the population of more than 1.7 million. State language is Kazakh language. In terms of administrative and territorial division Kazakhstan is divided into 14 oblasts and 2 cities of national importance: Astana and Almaty.

The country borders with Russia in the north and west, with China in the east, and with Kyrgyzstan, Uzbekistan and Turkmenistan in the south. It is the largest country in Central Asia. It is washed by the waters of the intracontinental Caspian and Aral Seas.

- In 2016, commodity group "Machinery, equipment, vehicles, instruments and apparatus" with the share of 39.3% of the total volume of imported goods was the most demanded. The top three countries exporting to Kazakhstan include Russia, China and Germany.
- Commodity group "Mineral products" accounts for the main exports of the Republic of Kazakhstan, which characterizes commodity orientation of the economy of Kazakhstan. Its share was 58.5% from total export of Kazakhstan in April 2016. Export in this commodity group is almost entirely represented by raw materials of fuel and energy complex[4].

4.2 Kyrgyzstan

Official name is the Kyrgyz Republic (KR). The area of the country is 199 951 km². Bishkek is the capital city. In terms of administrative-territorial division, there are 2 cities of republican significance and 7 oblasts in the country. The oblasts consist of 13 cities of regional significance and 40 districts. The country borders with China in the east, with Kazakhstan in the north, Uzbekistan in the west and Tajikistan in the south. It is a land-locked country.

The main export commodity items [5]: cotton, electricity, wool, meat, tobacco; gold, mercury, uranium, antimony, garments, footwear. The main export destinations include Switzerland (27.2 %), Russia (19.2 %), Uzbekistan (14.3 %), Kazakhstan (11.4 %) and France (6.7 %).

The main import items: oil, gas, machinery and equipment, chemicals, food. The main suppliers of imported goods include Russia (36.6 %), China (17.9 %), Kazakhstan (9.2 %) and Germany (8.2 %).

4.3 Tajikistan

Official name is the Republic of Tajikistan (RT). Tajikistan is located in the foothills of the Pamir and is a land-locked country. Total area of the country is 142 000 km². It is the smallest state in Central Asia. It borders with Uzbekistan in the west and north-west, with Kyrgyzstan in the north, with China in the east and with Afghanistan in the south. Dushanbe is the capital city. Administrative-territorial units of the Republic of Tajikistan include: Gorno-Badakhshan Autonomous Oblast; Sughd and Khatlon oblasts; districts of republican subordination; Dushanbe city.

[4] Monthly analytical report for April 2016. The Republic of Kazakhstan.

[5] Statistical Yearbook of the Kyrgyz Republic 2011-2015. Bishkek 2016.

Aluminum, led, zinc, rare earth metals, vanadium, uranium oxide, light industry products (cotton and silk fabrics), cotton, agricultural products (vegetables and fruit) are exported from the country. The main export destinations include the Netherlands (36.7 %), Turkey (26.5 %), Russia (8.6 %), Iran (6.6 %) and China (5.7 %).[6]

Ferrous metal, products of light industry, automobiles, agricultural machinery, food, pharmaceutical products, and medical equipment are imported. The main importing countries include Russia (32.3 %), China (11.9 %), Kazakhstan (8.8 %) and Uzbekistan (4.7 %).

4.4 Turkmenistan

Official name is Turkmenistan. The area of the country is 491 200 km^2. Turkmenistan is located in the southwestern part of the region in the desert zone, to the north of the Kopetdag Range of the Turkmen-Khorasan mountain range, between the Caspian Sea in the west and the Amudarya River in the east. Turkmenistan borders with the Republic of Kazakhstan in the north, with Uzbekistan in the northeast and east, with Afghanistan in the southeast, with the Islamic Republic of Iran in the south, in the west its natural border is formed by the Caspian Sea. The capital is the city of Ashgabat. It is subdivided into 6 administrative-territorial units, 5 of which are velayats, and one city with the rights of the velayat.

Natural gas reserves of Turkmenistan are fourth largest in the world. It has the second largest gas field in the planet[7]. Since 1993, Turkmenistan has limits on free electricity, water use and gas consumption, which have no precedents in the world.

There is very little statistical data on Turkmenistan in public space.

4.5 Uzbekistan

Official name is the Republic of Uzbekistan (RUz). Tashkent is the capital city. The area of the country is 447 400 km². Neighboring countries: Kyrgyzstan in the east; Kazakhstan in the north-east, north and north-west; Turkmenistan in the southwest and south; Afghanistan in the south and Tajikistan in the southeast. In the administrative and territorial respect there are 12 oblasts, 1 autonomous republic - Karakalpakistan and 1 city of central subordination – Tashkent in the country.

Uzbekistan exports cotton, gold, uranium ore, mineral fertilizers, metals, textile and food products and cars[8]. During 1991 – 2013, a significant change in the structure of exports of Uzbekistan was observed: energy carriers became the main commodity of the republic, their share in exports increased from 17.1 % to 31.1 %, at the same time the share of cotton fiber in exports decreased from 59.7 % to 7.7 %, however, the share of food increased from 3.9 % to 9.8 %, chemical products - from 2.3 % to 4.0 %, ferrous and non-ferrous metals from 4.6 % to 6.3 %, machinery and equipment from 1.7 % to 5.5 %.

Mainly industrial product are imported.

5 Coverage by product type

Within the framework of the study, 3 categories of electric or electronic equipment (EEE) groups have been considered. Categories of product groups selected comply with the Directive of the European Parliament and the Council of the European Union # 2002/96/EU as of January 27, 2003 “On electrical and electronic equipment waste”, namely:

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[6] Shkvarya L.V., Rusakovich V.I., Lebedeva D.V. Foreign economic relations of the Republic of Tajikistan with Asian states: current trends // Management of economic systems: an electronic scientific journal. — 2015. — # 6 (78). — page 12

[7] https://lenta.ru/news/2011/05/25/field/

[8] Migranyan A.A. - Specificity of the economic growth of Uzbekistan // Institute of CIS countries, 24.09.2012

Category 1. Large household equipment - combined refrigerators-freezers with separate external doors – FEACN of the EAEU 841810. Average product weight is 35 kg, the average service life is 10 years.

Household refrigerators with external separate doors that have lost their consumer properties:

Waste composition*[9]*: *Copolymer ABC*[10] *750 SW – 5-6%; heat insulation - a system of polyurethane foam components. Elastopore H 2030/53/OT, cyclopentane blowing agent – 11-13.84%; refrigerating medium 600a – 0.06%; carbon steel sheet rolled – 29.5-32.6%; aluminum and aluminum alloys – 0,9%; copper and copper-based alloys (brass, bronze) – 2.3%; paint and varnish materials. Chemical phosphate coating / polyester powder composition – 2%; polystyrene shockproof - 825 – 8.5-10%; tempered safety glass – 4-5%; polystyrene 525 – 4-5.3%; polystyrene shockproof PS 454N - 19-22%;*

Category 3. Equipment for information technology and telecommunications. In this category, 2 product groups have been selected:

1) - FEACN of the EAEU 847141. Average product weight is 9.9 kg, the average service life is 5 years;

and

2) - FEACN of the EAEU 851712. Average product weight is 0.1 kg, the average service life is 3 years.

Keyboards, mouse manipulators with connecting wires that have lost their consumer properties:

Waste composition: *Thermoplastic housing – 77%; textolite (printed circuit assembly) – 4.1%; polypropylene – 1.21%; rubber – 6.6%; insulation of wires (polyvinyl chloride) – 2.22%; iron – 4.83%; copper 3.85%; paper (with adhesive layer) – 0.1%.*

Computer system unit that has lost its consumer properties:

Waste composition: *Paper 0.008% ± 0.003%; rubber resin 1.06 ± 0.32%%; ceramics 0.008 ± 0.003%%; ferrous metal 48.89 ± 14.67%%; non-ferrous metal 11.19 ± 3.36%%; polyethylene 0.080 ± 0.029%%; foam rubber 0.018 ± 0.006%%; plastic 19.74 ± 5.92%%; glass 0.006 ± 0.002%%; textolite 19.0 ± 5.7%%.*

Computer LCD monitors that have lost their consumer properties:

Waste composition: *ferrous metal 6.2 ± 1.9%%; non-ferrous metal 4.3 ± 1.3%%; polymeric materials 32.3 ± 9.7%%; glass 57.2 ± 17.2%%.*

Telephones and fax machines that have lost their consumer properties:

Waste composition: *ABC*[11] *plastic (housing) – 56%; metals (iron, tin) – 18%; copper 16%; glass (display) – 3%; other – 7%.*

Table 3

Mobile phone components

Substance description	Usage in mobile phone	Normal percentage

[9] The data on waste component composition have been taken from the websites: http://ecobatman.ru/othodi_sostav.php и http://ecoportal.su/wastet.php.

[10] acrylonitrile butadiene styrene

[11] acrylonitrile butadiene styrene

The main components (1% and more):		
Plastics	Housing, printed circuit board	~40%
Glass, ceramics	LCD screen, microprocessors	~20%
Copper (Cu), compounds	Printed circuit board, wires, connectors, batteries	~10%
Nickel (Ni), compounds	Nickel-cadmium or nickel-metal hydride batteries	~2-10% *
Potassium hydroxide (KOH)	Nickel-cadmium or nickel-metal hydride batteries	≤5% *
Cobalt (Co)	Lithium ion battery	1-5% *
Carbon (C)	Batteries	≤5%
Aluminum (Al)	Housing, frame, batteries	~3% **
Steel, ferrous metal (Fe)	Housing, frame, battery charger, batteries	~10%
Tin (Sn)	PCB	~1%
Magnesium (Mg)	PCB	<1% When using Mg in the phone case the content will be much larger (~20%)
N o t e :	* only upon using batteries of these types, in other cases - a secondary or micro component ** if aluminum is used in the case, the value will be much larger (~20%)	

Category 5. Lighting equipment - mercury or sodium lamps; metal halide lamps - FEACN of the EAEU 853932. Average product weight is 0.25 kg, the average service life is 1.5 years.

Mercury lamps, fluorescent mercury-containing waste or reject pipes:

Waste composition: *Aluminum ~5%, luminophor ~3%, other ~2.3%, mercury ~0.15%, led ~2.55%, glass ~ 8 7%.*

6 Development indicators

The period from 2008 until now is characterized by negative impact of 2008 global financial crisis consequences, which resulted in the decline of the world commodity markets with reduced demand for hydrocarbons (except gas), aluminum, cotton and etc. In addition, for the economies of Kyrgyzstan, Tajikistan and Uzbekistan a significant reduction in the amount of money coming from labor migrants working in the Russian Federation, Kazakhstan and other countries was observed. According to the World Bank data[12], the ratio of remittances (more than 90% of which are coming from the Russian Federation and Kazakhstan) to GDP of Tajikistan and Kyrgyzstan remains the highest in the world since 2011 (being more than 30% in Kyrgyzstan and 40-50% in Tajikistan).

The economies of the countries under consideration are developing unevenly; the economic policy is based on various methodological concepts. At this stage, there are weak trends in intraregional integration of the economies of Central Asia, which could provide more effective and comprehensive mechanisms to strengthen the competitiveness of local production that currently sustain the intense competition with goods actively imported from the nearby Chinese market and the market of South - East Asia.

Socio-economic indicators of the Central Asian countries vary significantly. Kazakhstan is the largest in terms of area, Uzbekistan is the most populous, the highest poverty level and the largest increase in population is observed in Tajikistan, the largest proportion of urban population is reported in Kazakhstan. For comparison let us examine some of the economic indicators of the

[12] Labor migration, remittances and human development in the countries of Central Asia. A series of analytical notes on human development for the countries of Central Asia. 2015 Developed by the UNDP Regional Office for Europe and the Commonwealth of Independent States.

Central Asian countries, according to the World Bank data[13] for 2016. The size of nominal GDP (gross domestic product) is the largest in Kazakhstan being 133.66 billion USD, and the smallest is accounted for Kyrgyzstan - 6.55 billion USD. In terms of Gross National Income - GNI per capita - Kazakhstan is also the undisputed leader (22,910 USD) followed by Turkmenistan (16,060 USD); Uzbekistan is on the third place among five countries (6,640 USD). The biggest annual growth rate of gross domestic product in 2016 is reported in Uzbekistan (7.8 %) followed by Tajikistan (6.9%), while the lowest indicator is reported in Kazakhstan being 1%.

6.1 Kazakhstan

Strengths of Kazakhstan include: serious economic potential, receptive market - 17 million people plus the markets of the EAEU countries, legislative framework focused on attracting investors, presence of a package of programs aimed at development of non-resource economy, and, accordingly, creation of favorable conditions for investors in these spheres[14].

6.1.1 Population

There are 18,014,200 people living in Kazakhstan (as of July 1, 2017). The Kazakhs represent the indigenous population of Kazakhstan (63.1% of total population). The Republic of Kazakhstan is among the most sparsely populated countries in the world, the population density of the country is only 6.3 people per square kilometer. Kazakhstan is the most urbanized country in Central Asia. Urban population accounts for more than 60% from total population.

The main demographic indicators of Kazakhstan for 2016:

- the number of born: 399, 458 people;
- the number of deaths: 157, 615 people;
- natural population increase: 241, 843 people;
- positive migration balance: 33, 407 people;
- men: 8, 667, 334 (as of December 31, 2016);
- women: 9, 377, 390 (as of December 31, 2016).

According to the results of the National Population Census of the Republic of Kazakhstan in 2009, the number of households made up 4,391,759, of i 2,712,767 urban households and 1,678,992 rural households.

The households comprised of 3 members are the most common in the country (19.3%); in urban area the households of two members are the most common (22.2%), while in rural area the households of four members (19.3%).[15]

Table 4

Households in Kazakhstan

	Total	Urban	Rural
Households, total	4391759	2679954	1678992
Including consisting of:			
1 person	639,890	490,604	137,868
2 persons	834,846	607,797	233,416
3 persons	848,198	580,967	270,790
4 persons	825,198	527,017	324,080
5 persons	503,564	251,062	264,264

[13]http://databank.worldbank.org/data/Views/Reports

[14]http://e-ced.ru/upload/iblock/279/karta-investitsionnoy-privlekatelnosti-stran-tsentralnoy-azii-i-yuzhnogo-kavkaza-.pdf

[15] "Households of the Republic of Kazakhstan. The results of the National Population Census of the Republic of Kazakhstan in 2009". Statistics Agency of the Republic of Kazakhstan.

6 persons	305,542	129,842	200,658
7 persons	141,495	45,222	107,508
8 persons	74,983	22,084	59,460
9 persons	39,071	11,270	32,887
10 and more persons	46,618	14,088	48,061
The number of household members	14,803,632	8,344,772	7,318,127

In January 2016, the number of unemployed made up 457.6 thousand people, the unemployment rate was 5.1%. The share of registered unemployed was 0.7% of the economically active population. These are the data provided by the Statistics Committee of the Ministry of National Economy of the Republic of Kazakhstan.[16]

It should be noted that in December 2015 the number of unemployed amounted to 455,800 persons. In January 2016, in the economy of the republic, 8.5 million people were employed. In the employed population, the number of payroll employees in this period was 6.2 million people, which is 73.1% of the total number of employees. According to the data of the fourth quarter of 2015, out of the total number of self-employed people, the share of productive employment made up 78%, and 22% of unproductive employment. The level of hidden unemployment for this period was 0.4% (33.3 thousand people) of the economically active population.

According to the household survey, the share of the population with the incomes below the subsistence level in 2016 was 2.6%, having decreased 1.5 times during five years, informs the Statistics Committee of the Republic of Kazakhstan in its report on income differentiation in the Republic of Kazakhstan for 2016.

At the same time, significant differentiation of incomes in urban and rural areas remains. Thus, in urban areas the share of the population with incomes below the subsistence level was 1.3%, and 4.4% in rural areas. The poverty rate in rural area exceeded that of urban area 3.4 times.

The Gini index in 2013 was 26.33.

6.1.2 Environment

Atmospheric air: According to the data of the National report on the state of environment and natural resources use of the Republic of Kazakhstan for 2015[17], the volume of pollutant emissions from stationary sources into the air amounted to 2,180.0 thousand tons/year. Total emissions in 2015 accounted for 44% of the total emissions of 1990. In the period from 2010 to 2015, the main share of pollutant emissions in the air in the republic is attributed to sulfur dioxide and carbon monoxide.

Water resources: the main water resources reserves of the republic are concentrated in surface and underground sources. In general, water resources in Kazakhstan are unevenly distributed across the regions. Thus, 34.5% of all water resources are located in the eastern region, 4.2% - in the northern, 2.6% - in the central, 24.1% - in the south-eastern, 21.2% in the southern, and 13.4% in the western regions. Currently, water bodies are heavily polluted by the enterprises of mining, metallurgical and chemical industries, urban utilities and represent a real environmental threat. In 2015, there were 713 cases of high pollution (HP) and 9 cases of extremely high pollution (EHP) in 36 water bodies.

Land resources: in the structure of the land fund of the country, 100.1 million hectares (38.3%) of land reserve and 100.8 million hectares (38.6%) of agricultural land are predominant. As of November 1, 2015, 76.9% of the land fund is concentrated in these categories, and 23.1% in all other categories. According to the land balance data, as of November 1, 2015, there are 247.7 thousand hectares of disturbed lands in the republic, where there are dumps from overburden

[16] http://stat.gov.kz

[17] http://aarhus.ecogosfond.kz/wp-content/uploads/2013/10/140320171.pdf

operations and rock dumps, tailings, ash dumps, coal and mining quarries, oil fields and storage pits. Only as a result of non-ferrous metallurgy enterprises operation more than 22 billion tons of waste have been accumulated, including about 4 billion tons of mining waste; from toxic ones - over 1.1 billion tons of enrichment waste and 105 million tons of waste from the metallurgical processing. The area occupied by waste pits of non-ferrous metallurgy waste is about 15 thousand hectares, of which 8,000 hectares of rock waste dumps, the tailings of concentration plants occupy about 6,000 hectares and the dumps of metallurgical plants occupy more than 500 hectares. The same amount of waste is formed in ferrous metallurgy and chemical industry.

Waste: The total volume of accumulated industrial waste in Kazakhstan is more than 28 million tons. According to the data for 2015, the volume of industrial waste generated in the country is 982,211.796 thousand tons, of which 227,062.422 thousand tons were utilized, which amounted to 23.12%.

The total volume of accumulated solid domestic waste (SDW) in Kazakhstan is about 100 million tons, with about 5-6 million tons of solid waste generated annually. According to the data for 2015, the volume of generated solid waste in the country amounted to 5,467.254 thousand tons, of which 99.669 thousand tons were utilized, which is 1.8%, the rest volume is placed in the landfills.

According to the reporting data for 2015, there are more than 4,049 landfills and solid waste dumps in the country. Of these, 459 landfills are legalized. At that, most of the landfills have reached their expiration date, their reclaimation, as well as construction of new landfills complying with effective standards and rules are required.

Energy sector: Kazakhstan possesses large reserves of energy resources (oil, gas, coal, uranium) and is a commodity country that lives due to selling natural energy resources (80% of exports are commodities). Until 2010, Kazakhstan was a net exporter of electricity, and after 2010 the country is a net importer, that is, it consumes more electricity than it produces. The north of Kazakhstan exports electricity produced in the Ekibastuz GRES-1 power plant built in the Soviet period[18] to Russia, whereas the south buys the electricity from Kyrgyzstan and Uzbekistan. Available electric power of Kazakhstan is 4.0 MWh / person per year.

In 2015, generation made up 90.8 billion kWh (96.7% by 2014). Electricity consumption in the country amounted to 90.85 billion kWh (99.1% by 2014). In the structure of electricity generation, the share of TPPs[19] made up 91%, 9% of HPPs[20], and the share of RES[21] is less than 0.5%.

The main consumers of energy resources include industrial sector, including electricity and heat generation (36.9% of the total primary energy resources), the population (up to 30% of the total primary energy resources consumption) and transport sector (up to 20% of energy resources consumption).

6.1.3 Economy

Gross domestic product in 2016 amounted to 46,193,380.6 million tenge and increased in real terms by 1.0% compared to the previous year.

Table 5

Gross domestic product for 2013-2016

	2013	2014	2015	2016
Gross domestic product				
Billion tenge	35, 999.0	39, 675.8	40, 884.1	46, 193.4

[18] State regional power plant

[19] Thermal power plants

[20] Hydro power plants

[21] Renewable energy sources

Billion USD*	236.6	221.4	184.4	133.6
Index of physical volume, as a percentage to the previous year	106.0	104.2	101.2	101.0
Deflator, as a percentage to the previous year	109.5	105.8	101.9	111.9
Gross domestic product per capita				
	2, 113, 204.8	2, 294, 830.2	2, 330, 360.2	2, 595, 344.6
USD*	13, 890.8	12, 806.7	10, 509.9	7, 585.2

** conversion to US dollars is made based on the average annual official exchange rate of the National Bank of the Republic of Kazakhstan.*

For the period 1991-2015, the GDP structure of the Republic of Kazakhstan underwent some changes. So in 2015, the share of agriculture in the republic made up 4.7% [9.8% (2001)], industry - 27.8% [34.6% (2001)], services account for more than 50% [42.2% (1994)] of total production[22].

In gross added value, the share of oil and gas sector was 16.7%, 17.4% commodity sector and 76.9% non-commodity sector.

Diagram 1

Dynamics of change in the purchasing power parity ratio

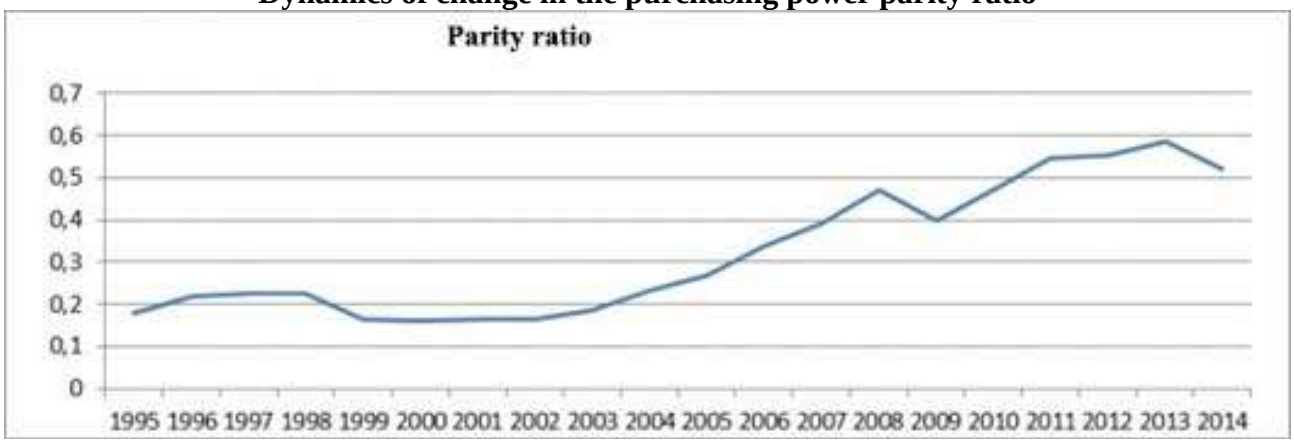
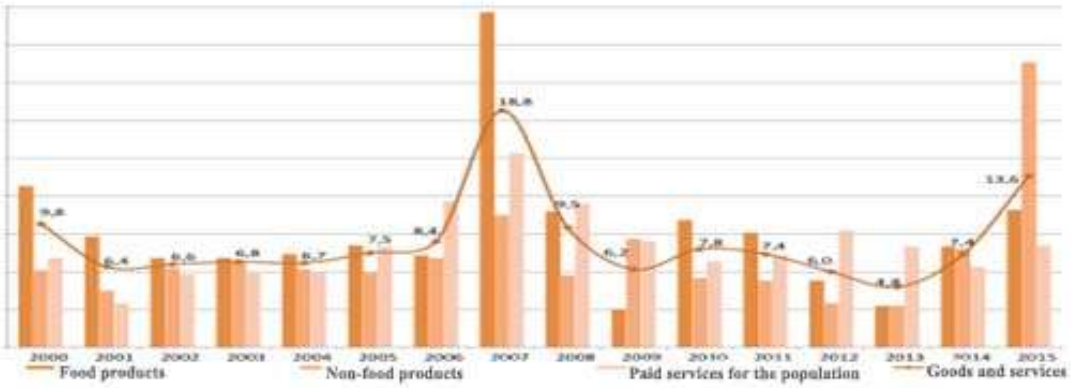


Diagram 2

Consumer price index in the Republic of Kazakhstan

(at the end of the period, as a percentage to December of the previous year, growth)



6.1.4 States and markets

According to statistical data on the availability of special equipment for digital signal reception, the people of Kazakhstan have expanded their opportunities for access to electronic

[22] Collected volume "Economy and Statistics" of the Ministry of National Economy of the RK, March 2016.

media. According to the World Economic Readiness Index 2012[23] of the World Economic Forum, Kazakhstan, followed by Russia and Azerbaijan, is the leading country of the Commonwealth of Independent States (CIS) for information and communication technologies development (ICT) and ranks 55th among 142 countries in the overall ranking. The position of Kazakhstan has significantly improved due to increased availability of ICT. Thus, in 2005, there were only 23 computers for 1000 people in Kazakhstan. By 2009, this indicator has increased almost threefold - to 62 computers per 1000 people (the data for subsequent years are absent). The share of Internet users among the population increased from 1.1 percent in 2008 to 49.5 percent in 2011. According to the state program "Information Kazakhstan 2020", by 2020, 100% of Kazakhstan households should have access to ICT; 75% of Kazakhstan citizens should use the Internet; digital signals of electronic media should cover 95% of the territory, and 100% of educational institutions should be linked to a single research and educational network.[24].

The indicator of provision of households with television sets, according to the Statistics Committee of the Republic of Kazakhstan, is high. In 2009, it made up 97%. Currently, statistical data are available until 2010. According to the ITU, the number of households equipped with television sets has increased from 1,893,542 in 2006 to 3,480,850 in 2009.

In recent years, a rapid growth is observed in extensive use of cellular communications (from 35% in 2005 to 155% in 2011), the only communication mean that outperformed the television in terms of its popularity.

With growing number of Internet users, the price of Internet connection has significantly decreased. According to ITU, in 2006, only 3% of Kazakhstan citizens used the Internet. At that time monthly subscriber fee for using fixed wired broadband communication was about 19,900 tenge (165 USD). A year later, it decreased to 3,800 tenge (32 USD). Thus, in 2008 the share of Internet users increased to 11%, to 18% in 2009, to 31.6% in 2010 and to 45% in 2011. According to the ITU, since 2010, the most popular way of Internet access is through a mobile operator. In 2011, there were 7.8 wired Internet connections per 100 residents of the country, 38 out of 100 residents used broadband mobile communications. The data of the Statistics Committee of the Republic of Kazakhstan[25] indicate that in 2011, 78.6% of Kazakhstan citizens accessed the Internet through a wired connection, while 60% used wireless communication.

The data on Kazakhstan regarding provision of household with domestic electrical appliances are presented widely, as regular accounting is conducted by the national statistical office in the country. In general, we can note the relatively high availability of all types of household appliances in the households in Kazakhstan, which may be explained by relatively high level of economic development and income of the population. According to official statistics, there are 770 incandescent lamps per 100 households, 250 halogen lamps, 29 LED lamps and 15 fluorescent lamps in Kazakhstan[26].

Diagram 3

Provision of households with domestic electrical appliances in Kazakhstan (the number of equipment units per 100 households)[27]

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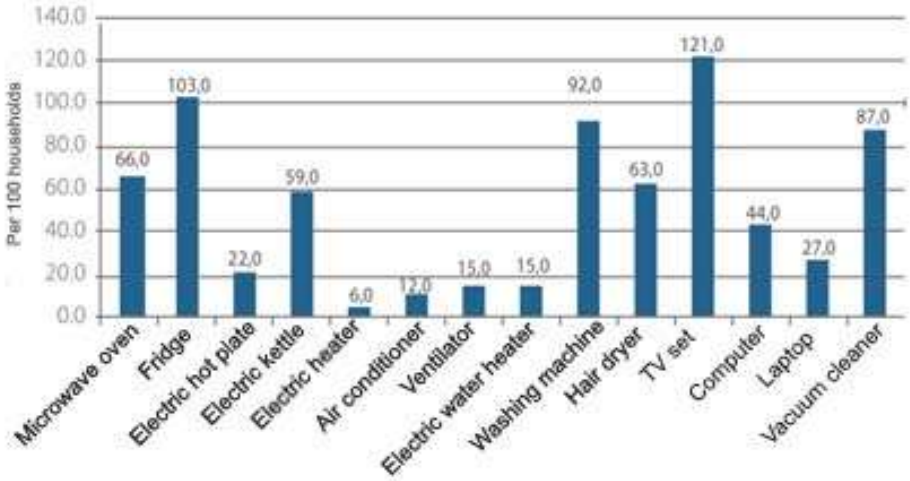
[23] World Economic Forum, Network Readiness Index 2012, http://www3.weforum.org/docs/GITR/2012/GITROverallRankings_2012.pdf (access date: April 17, 2013)

[24] The Decree of the President of the Republic of Kazakhstan "On state program "Information Kazakhstan 2020" and introduction of addition to the Decree of the President of the Republic of Kazakhstan as of March 1, 2010 # 957 "On approval of the list of state programs" as of December 4, 2012 # 1534", http://medialawca.org/posts/24-12-2012/67995.html (access date: April 17, 2013)

[25] http://www.stat.gov.kz/faces/homePage?_adf.ctrl-state=eu8w8v7c_17&_afrLoop=4457360459965995

[26] Assessment of energy consumption of household electrical appliances and energy efficiency policy of household appliances in Central Asian countries. UNDP, REC Central Asia. 2015.

[27] http://www.stat.gov.kz



Based on the data of the Statistics Committee of the Republic of Kazakhstan, expenditures for information and communication technologies of the enterprises and public sector of the republic in 2016 amounted to 269.5 billion tenge. Of this amount, 28.6 bn tenge is the share of public sector, and 240.9 billion tenge are accounted for business.

6.2 Kyrgyzstan

Kyrgyzstan with its relatively liberal legislation, efforts made by authorities aimed at creation favorable conditions for investment, has cheap labor force, favorable conditions for agriculture, light industry and tourism development and is a member country of the EAEU and thus has access to a unified market of the association. At the same time, it should be noted that with government intervention in the economy there are some serious precedents for creating difficulties for foreign investors in implementation of projects in the republic, the repeated revisions of agreements with foreign investors previously reached, the lack of policy continuity, high risks of political instability, spread of Islamist ideology, narrowness of internal market and low qualification of the workforce[28].

6.2.1 Population

As of the end of 2016, the population of Kyrgyzstan amounted to 6,089,859 people. In 2016, the population increased by approximately 99,853 people. Given that the population at the beginning of the year was estimated at 5,990,006 people, the annual increase made up 1.67% .

The main demographic indicators of Kyrgyzstan for 2016:

- the number of born: 162, 329 people;
- the number of deaths: 38, 516 people;
- natural population increase: 123, 813 people;
- positive migration balance: 23, 960 people;
- men: 3, 003, 839 (as of December 31, 2016);
- women: 3, 086, 020 (as of December 31, 2016).

One-third of permanent population (34%) lived in urban settlements and two-thirds (66%) - in rural areas. The population density on average was 30 people per square kilometer.

[28] http://e-ced.ru/upload/iblock/279/karta-investitsionnoy-privlekatelnosti-stran-tsentralnoy-azii-i-yuzhnogo-kavkaza-.pdf

Table 6

The population of oblasts, districts, cities, urban-type settlements of the KR in 2017. (estimate at the beginning of the year, thousand)

	permanent			available		
	Total population	including:		Total population	including:	
		urban	rural		urban	rural
The Kyrgyz Republic	6, 140.2	2, 073. 9	4, 066.3	5, 885,0	2, 051.6	3,833.4

According to the 2009 Population and Housing Census, there were 1 million 145.7 thousand private households in Kyrgyzstan with a population of 5 million 334.5 thousand people, or 99.5%. The rest are children in orphanages and boarding schools, the elderly people living in homes for the elderly and the disabled, as well as the population living in other specialized institutions.

In 2009, the average size of private households in the country as a whole was 4.7 people, with 3.8 people in the cities and 5.2 people in rural area. Half of all households consisted of 1-4 members, more than 30% of 5-6 members and about 20% had 7 or more members.

Table 7

Economic activity of the population[29]

	2012	2013	2014
Economically active population, thousand people	2,496.8	2,468.7	2,504.2
Economic activity level, %	64.2	62.5	62.4
Employed population, thousand people	2,286.4	2,263.0	2,302.7
Employment rate, %			
To the population in the age of 15 years and older	58.8	57.3	57.3
Payroll employees, thousand people	1,308.7	1,192.3	1,216.9
The share in employed population, %	57.2	52.7	52.8
Self-employed, thousand people	594.2	654.9	649.7
The share in employed population, %	26.0	28.9	28.2
Unemployed population, thousand people	210.4	205.7	201.5
Unemployment rate, %	8.4	8.3	8.0
Economically inactive population, thousand people	1,392.5	1,483.9	1,511.9

In Kyrgyzstan, the official unemployment rate of the economically active population is 2.2%. According to the statistics, the economically active population of the country is 2 million 504.2 thousand people. The total number of unemployed is 201.5 thousand people. 87.6 thousand people are registered in the employment services. Of these, 56,000 people are officially unemployed (including 29,700 women). During the year 206.5 thousand people applied to employment services. 50.7 thousand were employed.

Poverty level in 2016 calculated by consumer spending in the country as a whole was 25.4% and decreased compared to the previous year by 6.7%. To assess the poverty level, a poverty line of 2015 was applied as a threshold value adjusted according to the average annual consumer price index[30]. The value of the total poverty line in 2016 was 31,151 soms per year per capita, and 17,052 soms of the extreme poverty. The poverty level in rural areas decreased by 4.6%, and by 10.7% in urban settlements. There were 1 million 557 thousand people below the poverty line in 2016, of which 74% were the residents of rural settlements.

The Gini index is 33.4.

[29] According to the integrated sample survey of household budget and labor

[30] Approved by the Resolution of the Government of the Kyrgyz Republic as of March 25, 2011 # 115

6.2.2 Environment

Atmospheric air: the data on the state of environment are taken from the "National Report on the State of Environment of the Kyrgyz Republic for 2011-2014"[31]. According to the report, all classical air pollutants are typical for Kyrgyzstan. Emissions of stationary sources are dominated by such substances as particulate matter, sulfur dioxide, nitrogen oxides and carbon monoxide. Among the emissions, gaseous substances (63%) and particulate matter (37%) account for the largest share. The most significant emissions of gaseous pollutants include sulfur dioxide (31%); carbon monoxide (20%); nitrogen oxides (7%).

Water resources: The Kyrgyz Republic is the only country in Central Asia whose water resources are formed fully on its own territory, which is its hydrological feature and advantage. Kyrgyzstan possesses considerable resources of underground and ground waters reserved in rivers, perpetual glaciers and snow fields. Based on the results of analysis of microbiological water indicators for the period from 2011 to 2014, there is a slight decrease in the number of samples that do not meet the requirements of national legislation from 12.6% in 2012 to 6.5% in 2014. This figure remains high in Jalal-Abad oblast - from 10 to 28.3%, in the city of Osh - from 7 to 17.6%, and 5-6% in Batken oblast. Agricultural, industrial enterprises, municipal sewage systems and household waste are the main sources of water pollution. According to the National Statistical Committee, in 2015, 2.4 million m^3 of polluted waste water were discharged into the surface water bodies of the republic. This is 0.3 m^3 per a person.

Table 8

Discharge of polluted waste water to surface water bodies (mln. m^3)[32]

	2011	2012	2013	2014	2015
The Kyrgyz Republic	4.0	4.0	5.0	2.4	2.4

Land resources: according to the State Registration Service under the Government of the Kyrgyz Republic, the territory of the Kyrgyz Republic as of January 1, 2016, made up 199.9 thousand square kilometers. The largest share of the land area of the republic is included in reserve lands (43.8%) and agricultural lands (32.8%), the lands of SPNR amounted to 4.1% of the total land fund, the land of settlements occupied 276.2 thousand hectares or 1.4%. The lands of the water fund practically do not change and amount to 767.3 thousand hectares - 3.8% in the structure of the land fund.

Waste: in 2014, 112.7 million tons of production and consumption wastes were accumulated in the territory of 236 enterprises of the republic. A significant part of waste is located in the territories of the enterprises (122 waste disposal sites). On average, about one percent of the waste generated per year is transferred to other enterprises, mainly for use or disposal. Starting from 2013, there is a tendency to increase the volume of waste use in the territory of the enterprises. Thus, enterprises started using newly generated production and consumption wastes by 38% in 2013 and by 48% in 2014 explaining this by the availability of financial resources for these purposes.

The bulk of solid domestic waste consists of waste paper, broken glass, household items not suitable for further use, food waste, apartment and street sweeping, construction debris from repairs of apartments and broken household appliances. In the Kyrgyz Republic, an average of about 88 kg of household waste per inhabitant is accumulated annually, which are transported to landfills and dumps. In 2014, about 995 thousand tons of solid domestic waste were removed in the republic (by 18% less than in 2013), which are located in 202 dumps and landfills with a total area of about 285 hectares.

[31] "National Report on the State of Environment of the Kyrgyz Republic for 2011-2014". Approved by the order of the Government of the Kyrgyz Republic as of December 19, 2016 # 549-r

[32] "The environment in the Kyrgyz Republic. Statistical compilation of 2011-2015"

Existing containers and special vehicles do not meet the needs of the cities. There is no system for separate collection of waste (food waste, waste paper, textiles, scrap metal and etc.). There is no sorting and use of household waste as a secondary raw material, there is no waste recycling system.

According to the inventory carried out by the State Agency for Environmental Protection and Forestry, there are 366 landfills in the country with a total area of 669.70 hectares, of which 47 are authorized and 319 are unauthorized landfills. All authorized landfills in the republic in general exceeded their design capacity and function without complying with technical, sanitary and environmental safety standards. Both those and other landfills do not meet sanitary and hygienic norms and environmental safety requirements.

Energy sector: total installed capacity of electricity generation is 3,863 megawatts, 81% of which accounts for hydropower plants (HPPs) and 19% - for CHPPs[33]. More than 1.1 million subscribers are connected to electrical network with electrification level reaching 100%.

In the structure of fuel and energy resources consumption (FER) for industrial and technological needs the share of housing and communal services (hereinafter - housing and communal services) and the population in 2013 made up 43.5%, industry - 12.4%, transport – 39.5%, agriculture - 3.9%. At the same time, for the period from 2005 to 2013, consumption of fuel and energy resources by housing and communal services and the population increased 1.68 times, transport - 3.49 times; decrease in energy consumption by 2.6% and in agriculture by 27.4% was observed.[34]

The energy intensity of gross domestic product (hereinafter - GDP) in Kyrgyzstan, according to the International Energy Agency Key World Energy statistics, in 2014 amounted to 1.29 tons of oil equivalent (toe) per 1000 US dollars, with its world average value being 0.24 toe.

6.2.3 Economy

Gross domestic product (GDP), according to preliminary estimates, in January-November 2016 amounted to more than 402 billion soms, which is 3.2% higher than the level of the corresponding period of the previous year excluding the enterprises engaged in development of the Kumtor deposit, respectively, 363.7 billion soms and by 3.3%. GDP growth is mainly provided by the agriculture, industry, construction and services. At the same time, growth of commodity production sectors amounted to 103.7% and to 102.8% in services sectors.

Table 9

The main socio-economic indicators of the Kyrgyz Republic (mln. soms)

•	2013	2014	2015
Gross domestic product:			
Mln. soms	355,294.8	400,694.0	423,635.5
Per capita, soms	65,016.3	71,801.2	74,365.1

Employment structure in general is characterized by clear dominance of the agriculture. This sector (together with forestry and fish farming) accounts for 31.6% of all employed. The second largest employer is wholesale and retail trade and repair of cars and motorcycles, which provides 15.1% of all employment in the republic. The third priority is construction (11.0%), followed by the education (7.7%), manufacturing (6.9%), transport and storage (6.3%).

Consumer price indices for all goods and services in the Kyrgyz Republic in June 2017 made up 102.8% compared to December of the previous year.

[33] Central heating and power plant

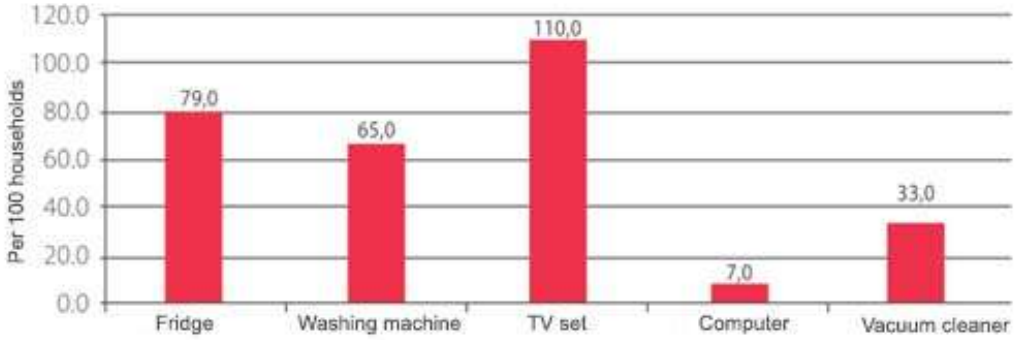
[34] The Program of the Government of the Kyrgyz Republic on energy saving and planning energy efficiency policy in the Kyrgyz Republic for 2015-2017. Approved by the Resolution of the Government of the Kyrgyz Republic as of August 25, 2015 # 601

6.2.4 States and markets

The information related to provision of the households with household appliances in Kyrgyzstan is taken from the statistical assessment carried out by the CIS Interstate Statistical Committee and covers only some basic types of household appliances. It should be noted that the available (estimated) data on the availability of household appliances are average across the country and do not reflect the differences between urban and rural households.

Diagram 4

Provision of households with household appliances in Kyrgyzstan (the number of equipment units per 100 households[35])



In 2015,[36] 11.4 thousand economic entities (enterprises and organizations) using ICT equipment were included in the monitoring of the condition and application of ICT conducted by the National Statistics Committee of the Kyrgyz Republic. Compared with 2011, the number of enterprises using computer equipment and information technology in the country increased 1.3 times. The share of business entities using ICT in urban settlements made up 67.3%, while in rural areas it amounted to 32.7%. The largest share of enterprises and organizations using ICT is reported in Bishkek (more than 40% of the total number), the smallest share in Talas oblast (about 4%). The share of state-owned economic entities using ICTs in 2015 in their total number made up 46.6%, and the share of economic entities with private ownership form made up 53.4%. Out of the total number of economic entities with state ownership (5,300), only 2.6% are connected to the State computer network, while 696 have their own websites, of which 351, or 50.4% are in Kyrgyz language.

In 2015, the number of specialists of enterprises and organizations directly operating in the field of information and communication technologies amounted to more than 20 thousand people and this number increased by 1.5% compared to 2011. The largest share was reported in Bishkek (27.2%), whereas the smallest share (about one percent) in Naryn oblast. The majority of specialists (69%) directly working in the field of ICT carry out their activities in state enterprises. The park of ICT facilities is presented in the following table:

Table 10

The data related to the availability of personal computers at the enterprises and organizations of the republic as of January 1, 2015

	The number of enterprises and organizations	Personal computers	The number of PCs during the year
The Kyrgyz Republic	11, 400	175, 320	14, 881
Bishkek	4, 639	95, 233	8, 986

[35] Interstate Statistical Committee of the CIS http://www.cisstat.com/

[36] National Statistical Digest “Information and Communication Technologies in the Kyrgyz Republic 2011-2015” National Statistical Committee of the Kyrgyz Republic, Bishkek city, 2016.

In the total number of office equipment, the share of printers accounted for more than 63%, and about 9% for copying equipment and scanners. More than half of office equipment available in the republic (50.5%) is in Bishkek.

About 46% of Internet access points accounted for state enterprises, including 60% of them operating in ADSL mode and via leased lines.

Table 11

The number of ICT equipment units

	2011	2012	2013	2014	2015
Personal computers	125,183	136,894	153,697	16,680	175,320
Availability of office equipment	21,322	22,957	24,152	25,368	25,856
Provision with telephone sets per 1000 people	88	85	79	75	68

6.3 Tajikistan

Tajikistan has cheap labor force along with some minerals and climate favorable for agriculture development. At the same time, the republic is characterized by underdeveloped infrastructure, a narrow internal market, high risks of political destabilization, corruption and bureaucracy, state interference in the economy, businessmen have no real mechanisms for protection of their rights[37].

6.3.1 Population

At the end of 2016 the population of Tajikistan amounted to 8, 769, 221 people. In 2016, the population of the Republic of Tajikistan increased by 192,295 people (8,576,926 people in the beginning of 2016). The annual population growth in 2016 made up 2.24%.

The main demographic indicators of Tajikistan for 2016:

- the number of born: 266, 228 people;
- the number of deaths: 48, 888 people;
- natural population increase: 217, 339 people;
- positive migration balance: 25, 045 people;
- men: 4, 310, 439 people (as of December 31, 2016);
- women: 4, 458, 782 people (as of December 31, 2016).

Of 68 districts and cities of the Republic of Tajikistan, 21 districts are mountainous. Urban population of Tajikistan at the end of 2016 amounted to 2 million 170.9 thousand, and 5 million 990.2 thousand of rural population. The ratio of men and women (according to Statistics Agency under the President of the Republic of Tajikistan): the number of men is 4 million 124,2 thousand, and the number of women is 4 million 360.9 thousand.

According to the 2010 Population and Housing Census of the Republic of Tajikistan, the number of household members total for the Republic of Tajikistan amounted to 7,523, 010 people, the number of households made up 1,197,187[38]. The largest number of households is reported in rural areas being 810, 510 (67.7% of the total number of households in Tajikistan).

The national average household size in 2010 was 6.3 in rural area and 5.8 in urban area. The size of households in 2010 increased compared to that in 2000 (5.1 in rural area, 4.5 in urban area).

[37] http://e-ced.ru/upload/iblock/279/karta-investitsionnoy-privlekatelnosti-stran-tsentralnoy-azii-i-yuzhnogo-kavkaza-.pdf

[38] Statistical book “The number and composition of the households of the Republic of Tajikistan” Volume V http://www.stat.tj/ru/img/526b8592e834fcaaccec26a22965ea2b_1355501252.pdf

The surveys conducted related to the number and size of households showed[39] that Tajikistan had the highest household size in EECCA countries.

The number of unemployed officially registered with employment service at the end of 2015 amounted to 60 thousand people, or 2.5%.

The total number of economically active population in Tajikistan in 2016 made up about 2.4 million people. From the total number of able-bodied population, 46.1% work in the agriculture, 19.1% in education, 8.8% in health and social security sphere and 5.2% in manufacturing industry.

The national poverty level of Tajikistan in 2014 made up 32%. The poverty line for 2014 was determined at the level of 158.71 somoni per month.

According to the survey conducted by the Statistics Agency with the support of the World Bank, the poverty level between 2012 and 2014 was 37%. The extreme poverty level measured by the food poverty line of 2,250 kcal per person per day decreased from 20% in 2012 to 16.8% in 2014.

Thus, the poverty level in Dushanbe is 19.9%; 37.3% in Gorno-Badakhshan Autonomous Region (GBAR), 37.7% in Khatlon region, 37.8% in the regions of republican subordination (RRS), 23.1% in Sughd region. The extreme poverty level in Dushanbe is 7.9%, 18% in GBAR, 21.6% in Khatlon region, 21.1% in RRS, 10.1% in Sughd region.

Gini index. According to the World Bank, the Gini index for Tajikistan was 30.8% in 2009, 32.6% in 2006, according to the CIA (Central Intelligence Agency).

6.3.2 Environment

The data on the state of environment of the Republic of Tajikistan are taken from the "Third National Communication of the Republic of Tajikistan under the United Nations Framework Convention on Climate Change"[40].

Atmospheric air: in Tajikistan, densely populated areas of Vakhsh and Gissar valleys, Sughd region, as well as the major cities of Dushanbe, Khojent, and Kurgan-Tube are of environmental concern in terms of atmospheric air pollution. The main sources of air pollution include non-ferrous metallurgy, mining and processing industry and energy sector. With decreased amount of emissions from stationary sources into the atmosphere, increase in emissions from motor vehicles is observed, which share in Tajikistan is 75%.

Water resources: in 2000-2010, the average annual intake of water from surface sources made up 9 km³ and about 2 km³ from underground sources. Specific water consumption in Tajikistan per person as of 2011-2012 was less than 1 thousand m³ per year. Tajikistan annually consumes about 15-20% of water volume that forms in the country. About one third (4 km³) of collected water returns to the rivers in the form of collector-drainage and other waste waters. There is no information regarding the types of pollutants.

Table 12

Operation of sewage treatment facilities in Tajikistan [41]

Parameters	2012	2014	2015
The number of sewage systems, units	106	103	**101**
Capacity of treatment facilities, thousand cubic m/day	583.6	706.4	**757.9**
Wastewater, total, thousand cubic m	81,212.8	87,528.4	**7,5387.4**
Wastewater treated by treatment facilities, total, thousand cubic m	73,981	79,388.2	**68,392.8**
including complete biological purification (physico-chemical)	71,069	73,581	**61,792**
The number of accidents	**7,447**	**7,543**	**9,717**

[39] www.cisstat.com/census/households

[40] "Third National Communication of the Republic of Tajikistan under the United Nations Framework Convention on Climate Change". Dushanbe, 2014 http://unfccc.int/resource/docs/natc/tjknc3.pdf

[41] Environmental Protection of the Republic of Tajikistan, Statistical digest, 2016

Land resources: the territory of Tajikistan is 141, 942 thousand km^2. 93% of the territory of Tajikistan is occupied by mountains belonging to the mountain systems of Central Asia – the Tien Shan and the Pamir. On the northern border of the Republic of Tajikistan there is the Fergana depression 300 km long and 170 km wide. The maximum length from north-west to south-east is 700 km and 350 km from north to south. The herbaceous and semi-shrub vegetation predominates. Features of the land fund and land use of Tajikistan are as follows:

- non-agricultural lands predominate in the country: rocks, screes, snowfields and glaciers, other unsuitable lands;
- areas of forests and shrubs are small;
- agricultural lands are mostly represented by natural pastures, and the arable land areas are insignificant;
- irrigated land, especially arable land is the most valuable part of the land fund;
- soils almost everywhere (80%) are subject to erosion processes.

There are 1.1 million hectares of irrigated lands and 25 million dry lands in the country, of which 6.5 million ha are pastures, 115,000 ha are gardens, 50,000 ha are vineyards, 10,000 ha are mulberry trees, 0.5 thousand ha are occupied by seedlings. 50 thousand hectares of land are occupied by residential buildings.

Waste: industry generates about 1-1.5 million tons of waste per year, approximately the same amount of solid household (municipal) waste is generated annually. The total amount of accumulated waste is 200 million tons. More than a hundred landfills of various waste types (household, chemical and industrial waste) occupy the area of 1.4 thousand hectares.

Energy sector: Tajikistan is the world leader in hydropower potential per territory unit (3.6 million kWh per 1 km per year), and almost all national electricity demand is met by HPPs. The structure of fuel consumption has undergone significant changes in comparison with 1991. By 2010, the consumption of gas fuel reduced more than 8-10 times (import of natural gas actually stopped), liquid fuel - 5-8 times. Industry and agriculture are the largest consumers of electricity in Tajikistan.

Table 13

Energy efficiency

	2003	2011	2012	2013	2014	2015
Power generation	16,509	16,238	16,974	17,115	16,472	17,162
Consumed power	16,518	16,113	16,313	16,171	15,160	15,829
Loss of electricity	2,527	2,271	2,445	2,528	2,804	2,670

6.3.3 Economy

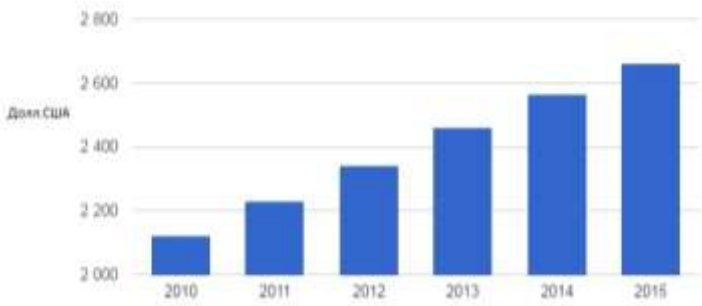
The economic policy of the republic is aimed at achieving three important strategic goals for the near future. Development of long-term economy of Tajikistan is related to implementation of the following strategies: achieving energy independence, ensuring food security, and addressing transport isolation. To develop the economy, the leadership of the country attracts foreign investment and creates a basis for further development of the economy. GDP in 2016 amounted to more than 54 billion somoni, GDP growth rate made up 7%.

In 2015, purchasing power parity (PPP) in Tajikistan was 2.01 LCU per international $, which is 0.019 LCU per international $ less than in 2014 (2.03 LCU per international $). The rate of PPP decrease compared to 2014 made up 0.941%. For the period from 2006 to 2015, purchasing power parity in Tajikistan increased by 1.2 LCU per international $, the average annual growth rate of PPP in Tajikistan for this period was 9.5%.

GDP (PPP) per capita in Tajikistan tends to grow (from 2,100 USD in 2010 to 2,650 USD in 2015)

Diagram 5

GDP (PPP) per capita in Tajikistan tends to grow [42]



18.9% of GDP in Tajikistan accounts for the agriculture, 21.9% for industry, 59,2% for services sector (in 2009). Public sector that controls major share of large industrial enterprises of the country remains the main sector of the economy.

Export of aluminum provides half of export earnings followed by the export of cotton.

Table 14

Consumer price index in Tajikistan in general tends to decrease

	Unit of measurement	2008	2009	2010	2011	2012	2013
Consumer price index	**%**	**111.8**	**105.0**	**109.8**	**109.3**	**106.4**	**103.7**

Consumer price index in Tajikistan in general tends to decrease.

6.3.4 States and markets

The state telecom operator "Tajiktelecom" is the main provider of fixed telephone services in the Republic of Tajikistan. Currently the number of fixed telephone subscribers is only 400 thousand, which clearly demonstrates predominance of wireless communications over wired communications. Of 400,000 users of fixed telephone services, 350,000 came into Tajiktelecom by inheritance of the Soviet Tajik public switched telephone network, which was converted to digital network in the early 2000s. The remaining infrastructure was newly created, now it belongs to the companies "Babilon-T", "Eastera" and "Telecom Technology".

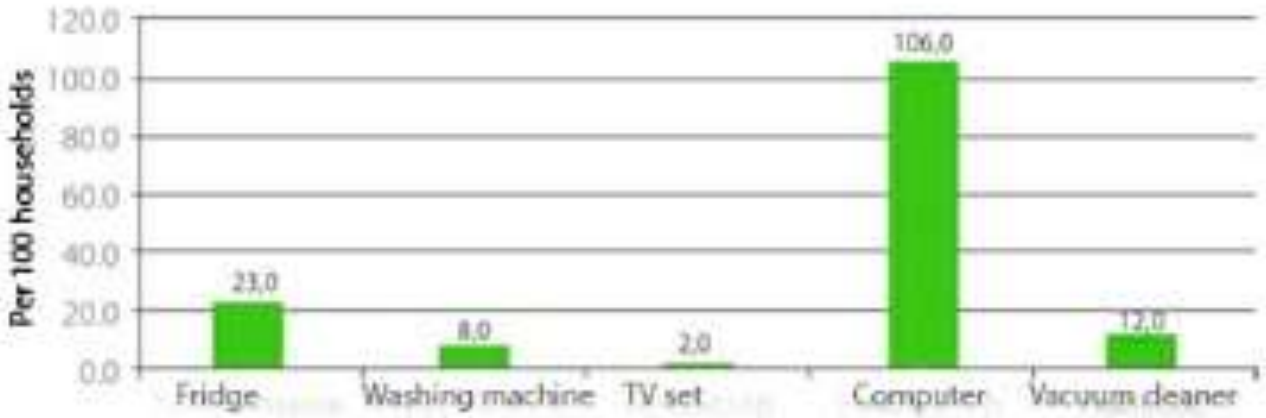
According to the Statistical Agency of Tajikistan, of the variety of household appliances, TV set is the most important for the population of the Republic of Tajikistan. Family budget survey carried out by the Statistical Agency showed that the TV set occupied an important place among all household appliances in the homes of residents of the republic. Every family has a TV set, whereas they may not have washing machine or vacuum cleaner. There are 173 "blue screens" for 100 families in Tajikistan, which means that on average there are two TV sets in each Tajik family.

In terms of availability of household appliances, such as a refrigerator, vacuum cleaner, washing machine, Tajikistan was ranked last among the CIS countries. For example, there are 23 refrigerators per 100 Tajik families, while there are 79 refrigerators per 100 Kyrgyz families.

[42] Source: TheGlobelEconomy.com. The World Bank

Diagram 6

Provision of households with household appliances in Tajikistan (the number of equipment units per 100 households)[43]



Vacuum cleaner is not common in Tajik homes, the country is on the third place in terms of presence of this household appliance: out of 100 Tajik families only 12 have vacuum cleaner. Others clean houses in the old-fashioned way - with the help of brooms. There is much less washing machines in the Tajik families - only 8 families out of 100 are owners of this type of household appliances.

In the beginning of 2013, the communications regulator of the Republic of Tajikistan published a report, according to which the number of Internet users in the country reached 3.7 million, or about 45% of the population. The International Telecommunication Union (ITU) reports much lower level of Internet coverage at 14.5%, which, according to Tajik experts, is largely underestimated. Active mobile communications users account for about 4.6 million people. Of every hundred active mobile users, 29 use mobile Internet.

Growth in the number of Internet users can be explained by a gradual decrease in the cost of Internet connection: 75% of users spend less than USD 20 per month on the Internet, most of these users spend 5 to 10 USD a month.

According to the rating of countries in the world by the number of mobile phone users compiled in 2014, the number of mobile phone users amounted to 8.7 million people.

ICT market in Tajikistan consisting of 150 licensed operators that generated half a billion dollars of income in 2012, which is an increase of 114 percent compared to the results of 2011 (CSGT 2013. Communication Service under the Government of Tajikistan Press Conference, "Conclusion of communications sector activities in 2012", January 30, 2013). For comparison, in 2012, the telecommunications sector paid twice as much as the industrial giant - *Talco* aluminum plant. Expansion of digital infrastructure has stimulated competition, increase in the number of jobs, access of the population to educational and social services.

6.4 Turkmenistan

Positive aspects of economic development in Turkmenistan include the availability of large hydrocarbon reserves, available transit capacity, political stability and continuity of the economic course, efforts of the authorities to reform the economy and maintain stability in the society. At the same time, the republic has a tough political model that assumes serious control over any economic

[43] Source: Interstate Statistical Committee of the CIS http://www.cisstat.com/

activity in the country; the country is characterized by weak protection of property rights, high corruption and bureaucracy, as well as the risk of destabilization due to crisis in Afghanistan, and dependence on hydrocarbon export.[44]

6.4.1 Population

The population of Turkmenistan is estimated in different ways in various external sources. The figures range from three (sometimes even two) to five and a half million people. According to the independent news agency *Chronicle of Turkmenistan*, received, as emphasized, from an unidentified source, there were 4,751,120 people in the country at the time of 2012 census.
2, 418, 115 or 50.9 percent of them are women, 2, 332, 005 or 49.1 percent are men. There are approximately 125,000 Turkmen citizens abroad. According to UN estimates, the population of Turkmenistan is about five million people.

According to unofficial sources, there are 24 cities in Turkmenistan, the largest of which is the capital of Ashgabat, the number of people living there exceeds one million (according to some estimates it is 800 thousand people).

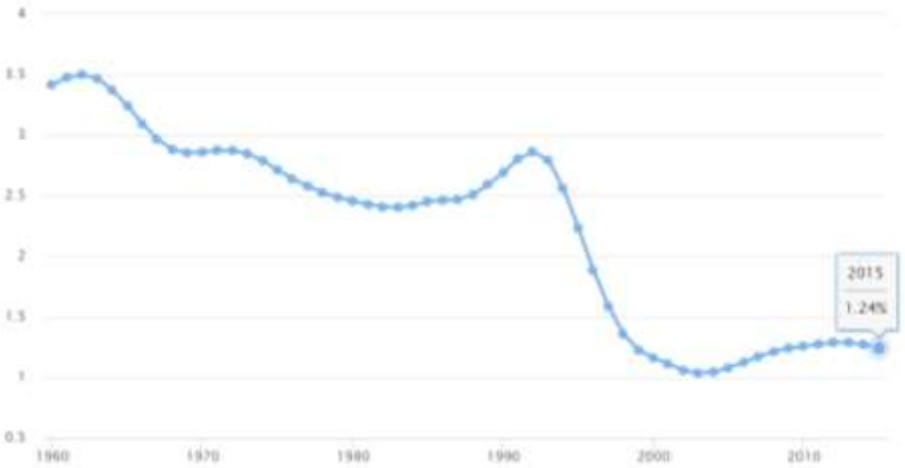
Population density is low. Some desert areas in the northwest have no population at all, but in the oases the population density immediately increases tenfold. According to some data, currently in average there are 11 people for one square kilometer. Previously this indicator was much lower. 60 percent of residents of Turkmenistan are concentrated in the zone of the Karakum Canal. The density is especially high in the Akhal, Murgap, and in the Lower, Middle and Upper Amudarya oases. More than 15% of total population of the country lives in the capital.

The main demographic indicators of Turkmenistan for 2016:

- the number of born: 116, 063 people;
- the number of deaths: 42, 023 people;
- natural population increase: 74, 040 people;
- positive migration balance: 5, 192 people;
- men: 2, 695, 924 people (as of December 31, 2016);
- women: 2, 781, 252 people (as of December 31, 2016).

Diagram 7

Growth rate of the population of Turkmenistan by years [45]

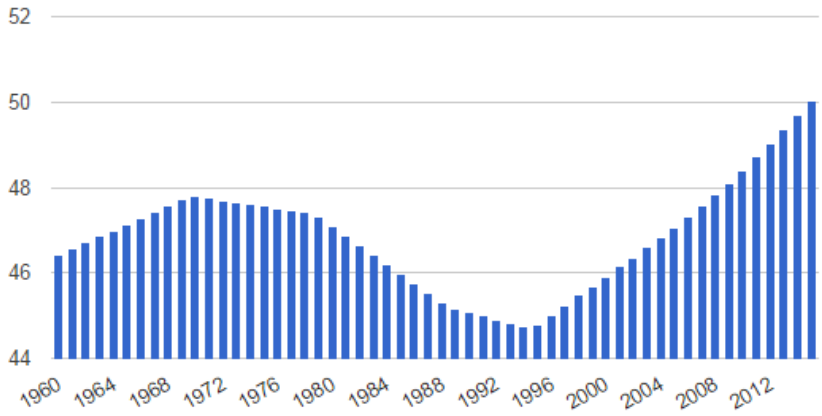


[44] "The map of investment attractiveness of the countries of Central Asia and South Caucasus" 2017. Expert Center Eurasian Development, ECED

[45] The statistical data show the change in the population of Turkmenistan compared to the previous year. Data are taken from the World Bank's report and are given in percentage.

Diagram 8

Percentage of urban population in Turkmenistan[46]



Official data on the number of households given in table 27 are available only for 2000.

Table 15

The number of households and their average size (Turkmenistan 2000)

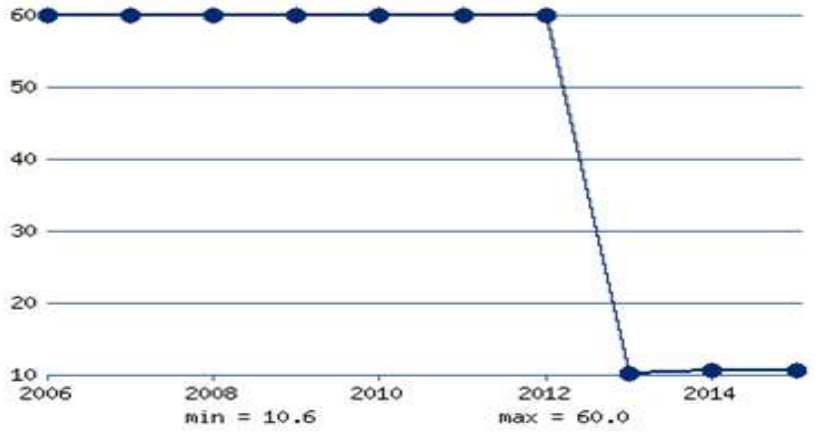
	Total population	Urban population	Rural population
The number of households, thousand	823.2	414.4	408.8
Including comprised of:			
1 person	52.0	38.5	13.5
2 persons	74.6	53.2	21.4
3 persons	93.8	59.7	34.1
4 persons	133.4	79.2	54.2
5 and more persons	469.4	183.8	285.6
The number of household members, thousand people	4,365.5	1,916,8	2,448.7
Average size of household, members	5.3	4.6	6.0

Taking into account the population census data for 2012 for the total population - 4,751,120 people and the average household size in Turkmenistan - 5.3 members per household, calculations were made of the number of households for the period 2012 that are needed to calculate the amounts of waste generated in this study. The number of households as a result of these calculations amounted to 896,437.

[46] Source - CIA World Fact book

Diagram 9

Unemployment rate of Turkmenistan, %



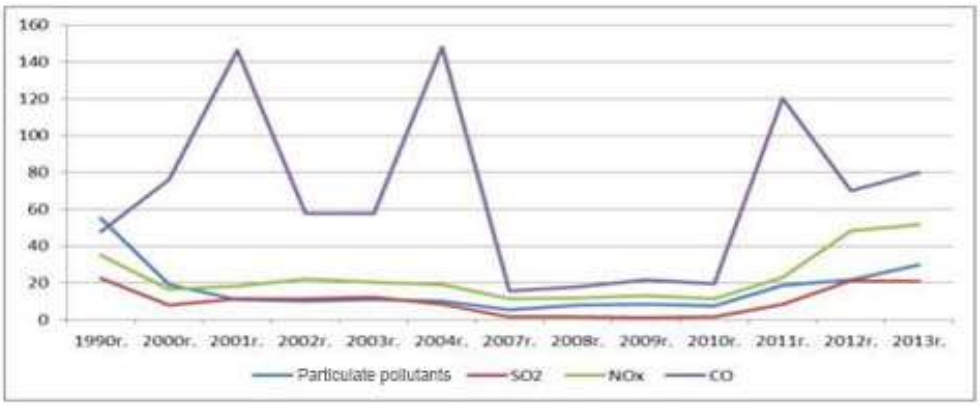
Poverty rate in Turkmenistan makes up 24.8%.
The value of the Gini Index is available only for 1998 and was 40.8.

6.4.2 Environment

Atmospheric air[47]: dustiness of the air is one of the distinctive features of environmental situation in Turkmenistan. The nature of the underlying surface (presence of huge sand massifs) with strong winds causes frequent occurrence of dust storms. Based on the data of the State Statistics Committee of Turkmenistan for 2013, the volume of emissions of pollutants into the air from monitored stationary sources was more than 350 thousand tons.

Diagram 10

Emissions of pollutants for 2000-2013



Water resources[48]*:* water is especially important in the conditions of Turkmenistan, where 70% of the territory is occupied by the Karakum Desert. The total volume of water resources in Turkmenistan is 25 км^3 of average annual water content, with the Amu Darya River accounting for approximately 90% of total surface water resources. The sources of the main rivers in Turkmenistan are formed in neighboring countries and, thus, are regulated by the international agreements on water distribution. Since water is currently used mainly for the agricultural sector (91.2%), and only then for the needs of industry (6.3%), domestic needs (1.9%), fishing industry (0.1%), other uses (0.6%), reduction of water flows will cause serious negative consequences for the agriculture, especially for cotton growing in the country.

[47] http://naturalresources-centralasia.org/flermoneca/assets/files/Report%20air%20quality-TM.pdf

[48] http://gbpp.org/wp-content/uploads/2014/09/Turkmenistan_Climate_Change_Profile_RUS.pdf

Land resources[49]*:* total area of land in Turkmenistan amounts to 49.1 mln. ha. Sandy deserts occupy up to 90% of the total area of pastures. Agricultural land makes up 39.97 million hectares, of which about 40 million hectares are pastures, 1.7 million hectares - arable land, the rest is perennial plantations and other types. Soil salinization, deflation and erosion represent important environmental problem in the country. Vegetation cover degrades, land productivity decreases, and the species composition of plant communities is impoverished in some parts of desert-sand pastures. 50.5% of desert pastures are subject to light blowing erosion, whereas in 45.0% moderate and in 4.5% strong blowing erosion is observed. In the areas of industrial and transport development of deserts, there are processes of sandy soil blowing, which requires measures for sand binding.

Waste:[50]*:* in April 2011, the Ministry of Communal Services of Turkmenistan was established by the special resolution of the President of Turkmenistan, which is responsible for collection, removal and disposal of solid domestic waste (SDW). The major share of solid waste includes food waste, paper and cardboard, glass and plastic comprising more than 75% of all solid waste. The integrated approach to address waste recycling issues is being developed in Turkmenistan. Production is established of rubber crumb, which is used to cover treadmills, fitness premises, gyms and etc. This production utilizes used tires. Positive environmental aspect of this production consists in the fact that now there is no need to dispose used tires that have been accumulated in the city dump before. In December 2007, in Rukhabat etrap of Akhal velayat a plant was put into operation for processing of garbage and household waste from the residential sector, medical and commercial organizations. Waste is sorted into glass, plastic and metal. A special building for disposal of potentially hazardous medical waste has also been built in the territory of the plant. Until now, there is no recycling of mercury-containing waste in Turkmenistan. Such extremely hazardous waste is thrown away together with household waste. Scrap metal was rather significant share of waste in Turkmenistan, which in the Soviet period and until 2009 was mainly exported near-abroad. The situation related to disposal of metal waste was completely resolved in May 2009 after commissioning of the first Metallurgical Plant in Turkmenistan.

Energy sector: Turkmenistan possesses the largest proven reserves of gas among the former Soviet republics, except the Russian Federation. Gas resources in the country are estimated at 22.9 billion cubic meters. Turkmenistan is the only country in the world where its citizens use electricity for free.

Diagram 11

Energy consumption per capita, Turkmenistan, [51]

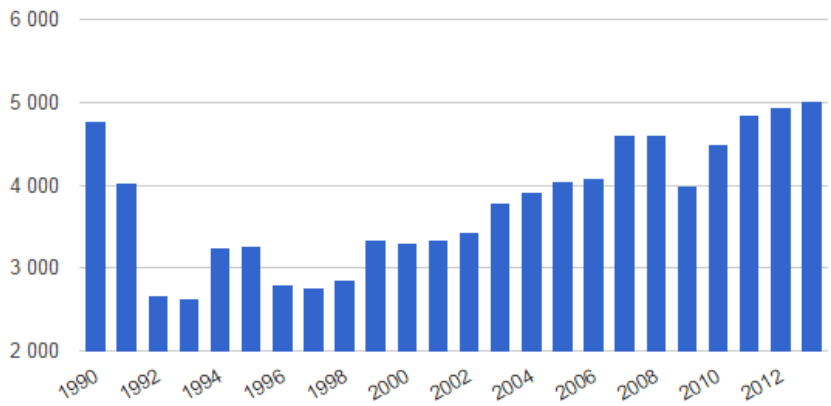


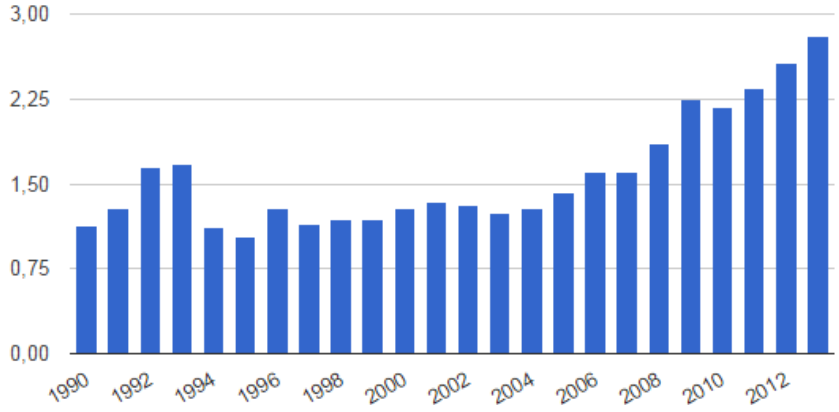
Diagram 12

[49] http://www.cawater-info.net/bd/turkmenistan.htm и http://nature-tm.narod.ru/index/0-67

[50] http://livingasia.online/la_data

[51] Source - CIA World Factbook

GDP per energy unit, [52]



6.4.3 Economy

Agriculture traditionally played an important role in the economy of Turkmenistan. The area of land under agricultural crops, orchards, vineyards exceeds 1.5 million hectares. About 95% of the whole crop area of the country is irrigated land. According to Western experts, in the agricultural sector of Turkmenistan, about 48% of working population, or about 1.3 million people are employed. The share of agriculture in the national GDP structure is about 8%. The chemical industry is also one of important sectors of the economy. The main types of chemical products produced in the country include mineral fertilizers, technical iodine and technical carbon, sodium sulfate, household chemical products and etc. Mechanical engineering is poorly represented, mostly by small enterprises. The machine-building plants of Turkmenistan produce oil centrifugal pumps, equipment for loading oil products into tanks and tankers, fans for industrial water coolers, electric cables, lighting equipment, cultivators, certain types of equipment for light industry, food industry and agriculture. Light industry is one of the most dynamically developing one. Currently, Turkmenistan processes most of the cotton that is grown. There are light industry companies in almost all large centers of the country[53].

Diagram 14

GDP growth rates, Turkmenistan, % [54]

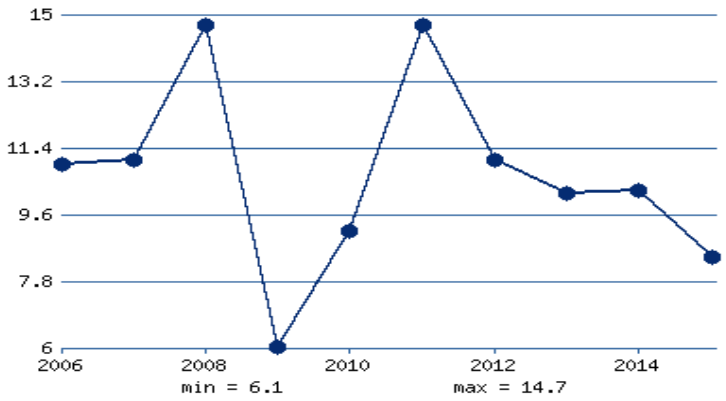


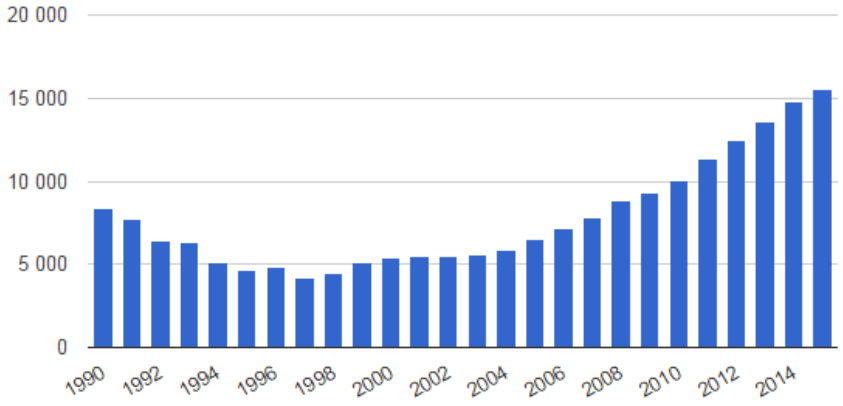
Diagram 15

[52] Source - CIA World Factbook

[53] Information portal Asgabat.net, article "Economy of Turkmenistan" http://asgabat.net/stati/nauka/priroda-i-geografija-turkmenistana/yekonomika-turkmenistana.html

[54] Source - CIA World Fact book

GDP per capita, PPP (Turkmenistan)[55]



6.4.4 States and markets

Practically every household has a TV set (100 percent), factory made carpet or palace (100 percent) and refrigerator (99 percent). Availability of a mobile phone, at least with one household member, is also very high (99 percent). Most households have sideboard or buffet (84 percent), a video recorder or DVD player (79 percent), washing machine (75 percent), air conditioner and vacuum cleaner (74 percent), sewing machine (72 percent). Approximately every second household owns a passenger car (55 percent), fixed telephone (51 percent) and bicycle (48 percent). There are differences depending on locality and region of residence. The greatest differences depending on the locality have been identified in terms of availability of fixed telephone (in urban households - 85 percent, and 22 percent in rural households). In urban settlements, every second household (51 percent) owns a computer or a laptop, and every third household (34 percent) in a rural area. The availability of air conditioner, washing machine and vacuum cleaner is more typical for urban households (from 87 to 90 percent), while the availability of these items in rural households is from 60 to 64 percent. Households of the Dashoguz velayat, compared to households in other regions, are least provided with air conditioning (35 percent), washing machine and vacuum cleaner (52 percent each), while in Ashgabat, there is very high availability of these items (from 94 to 98 percent). 44 percent of households own hand-made carpets (woolen or silk).

Table 16

Percentage of households owing selected household and personal items by the place of residence in Turkmenistan, 2015-2016 [56]

Percentage of households that own:	Total	Locality	
		Urban	Rural
Radio set	15.1	13.3	16.6
Any type of TV set	99.7	99.8	99.7
TV set (except plasma and LCD)	72.4	56.3	85.5
Plasma or LCD TV set	57.7	69.8	47.8
Fixed-line telephone	50.5	85.0	22.3
Fridge	99.4	99.7	99.1
Air conditioner	73.9	90.6	60.3
Washing machine	74.5	87.3	64.0
Vacuum cleaner	73.7	87.1	62.8
Computer / laptop	41.2	50.6	33.5
Video recorder or DVD-player	78.9	80.3	77.8
Tape recorder or CD-player	30.8	28.5	32.6
Mobile phone	98.6	98.1	99.0

[55] Source - CIA World Fact book

[56] The data of State Statistics Committee of Turkmenistan. http://www.stat.gov.tm

Percentage of households that own:	Total	Locality	
		Urban	Rural
iPad	9.8	15.3	5.3

Diagram 16

Subscribers of Internet, per 100 people, Turkmenistan[57]

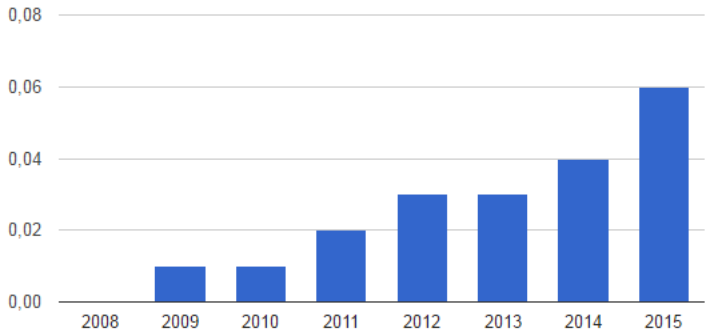
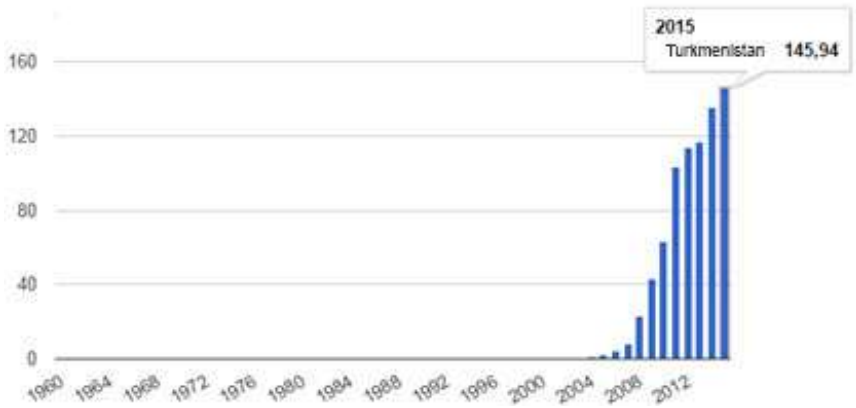


Diagram17

Mobile operators subscribers per 100 people, Turkmenistan[58]



6.5 Uzbekistan

Uzbekistan has the most receptive domestic market (over 30 million people), a diversified economy, its own resource base, and political stability. In addition, large-scale plans are shaped of the new president of the republic Sh. Mirziyeev on systemic reforming of the economy of the republic and creation of favorable conditions for investors. At the same time, there are strong interference of the state in the economy, non-liberalized currency market, violations of the rights of investors and entrepreneurs by the authorities and law enforcement agencies, corruption and bureaucracy, presence of social contradictions, low purchasing power of the population[59].

[57] Source - CIA World Fact book

[58] Source - CIA World Fact book

[59] "The map of investment attractiveness of countries of Central Asia and South Caucasus" 2017. Expert center *Eurasian Development* (ExpertCenterEurasianDevelopment, ECED)

6.5.1 Population

Uzbekistan is the most densely populated state among the countries considered and it is on the third place among the CIS countries by the population size, giving way only to Russia and Ukraine. The population of Uzbekistan exceeds 31.5 million people (as of January 1, 2016). About 80% of current population of Uzbekistan are Uzbeks, over 10% are representatives of other peoples: Tajiks (4.5%), Kazakhs (2.5%), Karakalpaks (2%), Kyrgyz, Turkmen and others (1%). Russians and other Slavic peoples (10%) remain one of the largest ethnic minorities.

The main demographic indicators of Uzbekistan for 2016:

- the number of born: 702, 827 people;
- the number of deaths: 211, 782 people;
- natural population increase: 491, 045 people;
- positive migration balance: 40, 669 people;
- men: 15 198 025 people (as of December 31, 2016);
- women: 15 377 792 people (as of December 31, 2016).

There are 118 cities in the Republic of Uzbekistan, including 2 republican, 26 regional and 90 district jurisdiction. In the total number of cities, small towns (up to 50 thousand people) account for 68.1% or 81 units, where almost 2.0 million people live or 20.5% of all urban residents. The mid-size cities (from 50 to 100 thousand people) include 21 cities with a total population of 1.4 million people. The category of large cities (from 100 to 250 thousand people) in the Republic includes 11 units, and large cities - 5 units. (from 250 to 1 million people). The city of Tashkent remains the only major city in the country with a population of 2.3 million. There are 1085 urban settlements in the Republic, with 6 million people, or 39.1% of the total urban population. Urban settlements mainly contribute to formation of population urbanization.

Due to positive structural changes and high rates of economic growth, real incomes increased by 11%. About 726,000 people were employed, including 438,500 graduates of the educational institutions.

Table 17

Income of the population[60]

Indicators	Unit of measurement	2012	% to the previous year	2013	% to the previous year	2014	% to the previous year	2015	% to the previous year
Employed population, (annual average)	Thousand people	12,223.8	102.6	12,523.3	102.5	12,818.4	102.4	13,058.3	101.9
Average nominal wage paid for the last month of the year	Thousand sums	1,056.6	114.7	1,203.1	113.9	1,366.9	113.6	1,549.6	113.4
Average pension for the last month of the year	Thousand sums	274.0	125.4	330.8	120.7	404.3	122.2	438.2	108.4

6.5.2 Environment

Website of the State Committee of the Republic of Uzbekistan for Nature Protection is the source of data on the state of environment[61]

[60] Figures are given taking into account the results of the survey conducted in accordance with the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan # 71

[61] http://www.uznature.uz/

Atmospheric air: Gross emissions of pollutants into the atmosphere from stationary and mobile sources characterize the general anthropogenic load on atmospheric air. The total amount of air emissions reduced to 2.0 million tons or 2.1 times, compared to 1989 for industry, energy and transport. The tendency to reduce emissions of pollutants into the air in the country as a whole occured due to a certain decline in production in certain sectors of economy due to reforming and reconstruction of industrial enterprises. More than 150 types of pollutants get to the atmospheric air from stationary sources, which makes the main contribution to emissions of solid substances (including heavy metals, vanadium pentoxide and benz (a) pyrene), sulfur dioxide and specific highly toxic harmful substances such as ozone, methyl mercaptan, phosphoric anhydride, arsenic and others.

Water resources: the Amudarya and Syrdarya Rivers are the main sources of surface runoff in the Republic of Uzbekistan, the total average long-term runoff is 116.48 km^3. The quality of river waters coming from the mountainous areas of their formation (within the Republic of Uzbekistan) is very high - practically these waters are not contaminated and their mineralization is very low. However, as we move down, water quality deteriorates sharply. Based on the results of state monitoring, the majority of surface watercourses in the Republic, in accordance with accepted WPI classification (water pollution index), belong to the third class of moderately polluted waters. A small number of watercourses, such as the Chatkal, Ugam, Aktashsai and Kyzylcha Rivers, belong to the II class of pure waters. It should be noted that stabilization of water quality is observed in the main rivers of the Republic of Uzbekistan in recent years, in the upper reaches of which water quality gets from class III of moderately contaminated to class II of clean water.

Land resources: the territory of the Republic of Uzbekistan, with an area of 447.97 thousand km^2 is located in the center of the Aral Sea basin and belongs to the zone with an arid climate by its natural and climatic characteristics. The landscape of Uzbekistan includes various forms of relief - from mountain ranges to lowland plains and plateaus. Mountains and foothills occupy 21.2% of the territory of the country, the flat lands occupy 78.8%.[62]

Table 18

The land fund of the Republic of Uzbekistan as of January 1, 2013

Land fund category	Total area, ths. ha		Including irrigated land	
	Total	Share, %	Total	Share, %
Agricultural land	20,481.1	46.12	4211.4	9.48
Land of settlements	214.1	0.48	49.9	0.11
Land of industry, transport, communications, defense and other purposes	914.5	2.06	12.0	0.03
Lands of nature protection, health improvement and recreational purposes	75.9	0.17	0.9	0.002
Lands of historical and cultural significance	6.2	0.01	0.0	0.0
Forest fund land	9,636.9	21.70	31.4	0.07
Water fund land	831.4	1.87	4.6	0.01
Reserve land	12,250.2	27.59	2.0	0.004
Total, lands	44,410.3	100.0	4,312.2	9.71

Waste: More than 100 million tons of industrial waste is generated in Uzbekistan annually, about 14% of which are classified as toxic waste. The greatest amount of waste is produced in mining and processing industry. According to the ministries and departments, about 30 million m^3 of domestic waste is generated annually in the republic. Central Tashkent enterprise and its 24 branches in the regions are responsible for collection of electronic waste. The joint-stock company

[62]http://nd.uznature.uz/page/prirodno-klimaticheskie-harakteristiki-i-sotsialno-ekonomicheskoe-razvitie-uzbekistana

“Tashkent plant for collection and processing of scrap, non-ferrous metals waste” established in 2006 is the only specialized company in Central Asia for collection and processing of secondary non-ferrous metals, as well as for receiving used batteries from the population. In 2013, JSC “Tashrangmetzavod” recycled less than a hundred tons of electronic waste; in 2015, it recycled 160 tons, in 2017 it is planned to collect and utilize more than two hundred tons of waste. The capacity of production established on the basis of *Uzvtorcvetmet*, allows to increase volumes in the short term to three hundred tons per year. Semi-finished products are produced from electronic waste such as aluminum ingots, copper and brass alloys. The assortment of finished products is still small including enameled wire, aluminum pans.

Energy sector: energy base of the republic consists of 42 power companies with a total installed capacity of over 12.0 million kW, including 10 thermal power plants with the capacity of 10.6 million kW (85.1%) and 29 hydropower plants with the capacity of 1.4 million kW (11.4%), other installations account for 480 million kW (3.5%). The largest thermal power plants in Uzbekistan have the following installed capacity: Syrdarya TPP - 3000 MW, Novo-Angren TPP - 2100 MW, Tashkent TPP - 1860 MW, Navoi TPP - 1250 MW and Talimarjan TPP 800 MW. The majority of hydroelectric power stations are combined into cascades of hydroelectric power stations. The largest hydropower plants including the Charvak HPP (620.5 MW), the Khodjikent HPP (165 MW) and the Gazalkent HPP (120 MW) have reservoirs that allow the hydroelectric power plants to operate in power regulation mode, the remaining HPPs operate in the basic mode. It should be noted that major share of supplied electricity is consumed by industrial enterprises, agricultural consumers and the population. Annual electricity consumption in the republic (per capita) is 1940 kWh.

6.5.3 Economy

High rates of economic growth have been achieved while maintaining a macroeconomic balance characterized by a positive balance of foreign trade turnover, a surplus of the state budget of 0.1% of GDP and a low inflation rate of 5.7%.

The increase in industrial output amounted to 6.6%, contract construction work - 12.5%, retail turnover - 14.4%, services - 12.5%.

Table 19

The main indicators of socio-economic development of the Republic of Uzbekistan for 2016 (as a percentage to 2015)

Indicator	Growth rate
Gross domestic product	107.8
Industry (including construction)	106.6
Agriculture, forestry and fishery	106.6
Services, total	112.5
Retail turnover	114.4
Amount of disbursed investment	109.6

More than 16.6 billion USD were invested in the economy in 2016, or by 9.6% more than in 2015. The amount of foreign investments and credits increased by 11.3% and exceeded 3.7 billion USD.

In 2016, 164 large production facilities with a total value of 5.2 billion USD were implemented. Construction of two combined-cycle plants with the capacity of 450 MW at Talimarjan TPP and 130-150 MW power unit at Angren TPP was completed, the capacity of cement plant in Jizzak oblast, spinning facilities at *Indorama Kokand Textile LLC*, and *Fantex LLC* was expanded, serial manufacturing of T-250 passenger cars at *JSC GM Uzbekistan* was organized, as well as production of sterile single-use syringes at the joint venture *Guliston Med Texnika* and etc.

In addition, within the framework of territorial programs of socio-economic development of regions in 2016, over 28,000 projects were implemented.

More than 80 new types of industrial products were mastered by the enterprises included in the Program for Localization of Production of Finished Products, Components and Materials for 2015-2019. In general, for 2016, the estimated effect of import substitution amounted to about 2.1 billion USD.

Implementation of projects on modernization, technical and technological renewal of industry, as well as the Program of measures to reduce energy intensity, ensure introduction of energy-saving technologies in the economic and social sectors for 2015-2019 led to a decrease in energy intensity of national GDP by 7.4%, as well as the production cost of large enterprises on average by 10.6% compared with the previous year[63].

According to the International Monetary Fund (IMF), GDP growth in Uzbekistan in 2016 amounted only to 5%.

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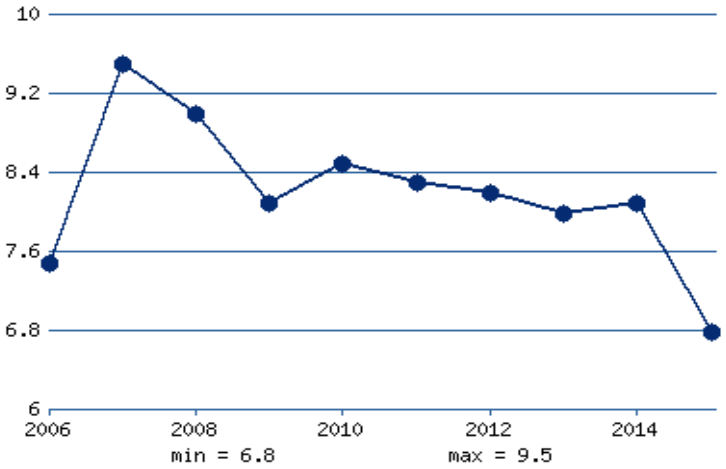
[63] The results of socio-economic development of the Republic of Uzbekistan for 2016 published by the Ministry of Economy of the RUz.

Diagram 18

GDP growth rate in Uzbekistan, %[64]



6.5.4 States and markets

Within the frame of implementation of the Program for Development of Service Sector for 2016-2020, 1632 new mobile base stations were commissioned.

The number of Internet users in Uzbekistan has exceeded 12 million. The number of mobile subscribers in the country is more than 22 million. The number of households with a computer currently makes up 37.4%; 58.1% of households have Internet access[65]. Within the framework of the Program for Development of Telecommunication Technologies, Networks and Communication Infrastructure for 2013-2020, during 2016, construction and reservation of more than 2300 km of fiber-optic broadband access networks using modern technologies was performed. During the reporting period, over 929 thousand services were provided through the Unified Portal, with a growth being 2.2 times compared to the same period of the previous year.

The average number of telephone numbers per 100 people in the country by the beginning of 2008 reached 7.7 units. In Tashkent this indicator was determined at the level of 31.3 units. The utilization ratio of local public switching stations throughout the country in the beginning of 2009 was 88.3%, and in rural areas, more than a quarter of the available capacity of telephone numbers was not used.

Qualitative changes have taken place in terms of level and structure of provision of the population with durable goods, most of which are currently produced in Uzbekistan. In particular, provision of families with mobile phones makes up 234 per 100 families.

The base tariffs in 2015 were as follows:

- 4.72 USD for mobile communication;
- 6.59 USD for fixed broadband Internet access with the speed of 0.25 Mb/sec;
- mobile broadband Internet access in 2015 with a monthly package of 1000 MB is 10 USD[66].

Today, there are 22 DVB-T digital television transmitters installed in Uzbekistan, thanks to which more than 54% of the population is covered by digital TV signals. These are residents of Tashkent and most of the districts of Tashkent, Samarkand, Khorezm, Bukhara, Andijan, Namangan, Fergana, Navoi, Kashkadarya regions, as well as the Republic of Karakalpakstan.

According to customs statistics for the period of 2011-2013, more than 470 thousand units of office equipment, about 1,500 units of TV sets, about 368,000 units of reception equipment for TV sets, and about 482,000 mobile phones (excluding those imported by the individuals) were

[64] Source - CIA World Fact book

[65] Materials of Information and Communications Technology Summit, ICTSUMMIT 2015

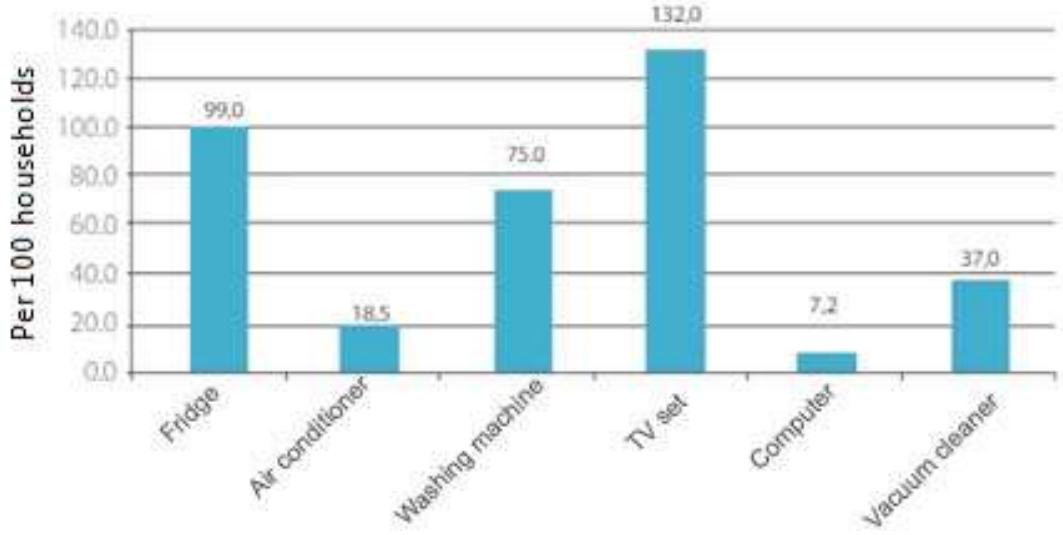
[66] The annual report of the International Telecommunication Union (ITU), 2016

imported to the republic. In this case, the greatest increase in imports in monetary terms were reported for air conditioners, TVs and electric heaters. In the structure of imports, air conditioners, refrigerators, TV sets and electric heaters have the largest shares, while vacuum cleaners have the smallest share[67].

Estimates of the levels of households' provision with the main types of household appliances in Uzbekistan are available in reviews of the national electro technical company.

Diagram 19

Provision of households with household appliances in Uzbekistan (the number of equipment units per 100 households)[68]



The national holding company "UZELTEHSANOAT" is the largest producer of household electrical appliances in the country. According to the report of this company, in 2015, nomenclature of consumer goods produced is as follows: air conditioners - 99.1 thousand, washing machines - 125.0 thousand, vacuum cleaners - 82.4 thousand, microwaves - 34.2 thousand, refrigerators - 135.2 thousand, kitchen equipment - 187.8 thousand, TV sets - 162.2 thousand, mobile phones - 77.0 thousand, energy-saving lamps - 3.172 million and other[69].

[67] Assessment of household appliances energy consumption and energy efficiency policy of home appliances in Central Asia. 2015

[68] Source: Interstate Statistics Committee of the CIS http://www.cisstat.com/

[69] Source: HC "UZELTEHSANOAT"

7 Policy and legislation

7.1 Kazakhstan

The Environmental Code of the Republic of Kazakhstan adopted in 2007 is the main normative legal act defining requirements in the field of waste management. The Environmental Code of the Republic of Kazakhstan establishes the requirement for separate waste collection and separation of hazardous waste components for subsequent processing.

Implementation of the Extended Responsibility of Producer (RRP) in the Republic of Kazakhstan is regulated by the Law of the RK as of 16.11.2015. # 407-V "On amendments and additions to certain legislative acts of the Republic of Kazakhstan concerning the issues of industrial and innovation policies", which amended and supplemented the NLAs of the Republic of Kazakhstan with regard to requirement for implementation of the RRP, the areas of activity of the RRP operators and their legal status and powers, responsibility of participants of extended responsibilities of producers (importers) and etc. In accordance with these innovations in the legislation, the following regulatory acts were also developed and adopted:

The Resolutions of the Government of the RK:

- as of 27.012016 # 28 "On approval of implementation of extended responsibility of producers (importers)";
- as of 27.012016 # 1137 "On identification of the operator for extended responsibility of producers (importers)".

The orders of the Ministry of Energy of the RK:

- as of 25.12.2015 # 761 "On approval of requirements for in-house system of collection, processing and recycling of waste";
- as of 04.12.2015 # 695 "On approval of the list of products subject to extended responsibilities of producers (importers)";
- as of 25.12.2015 # 762 "On approval of the methodology for calculating fees for organizing collection, transportation, processing, disinfection, use and (or) recycling of waste";
- as of 10.12.2015 # 708 "On approval of the Rules for submission by producers (importers) having their own system of collection, processing and recycling of waste of documents confirming collection, processing and (or) disposal of waste generated after the loss of consumer properties in products (goods) subject to extended responsibility of producers (importers) and its packaging to the operator of extended responsibility of producers (importers)".

Currently, national standards of the Republic of Kazakhstan are being developed. Within the framework of this activity, draft state standard ***"Waste of electronic and electrical equipment. Safety requirements for handling"*** has been developed at the initiative of the environmental department of the Republic of Kazakhstan in order to implement the provisions of the Environmental Code of the Republic of Kazakhstan and ensure establishment of an effective system for collection and further processing of waste in Kazakhstan. This draft establishes requirements for separate collection of EEE waste, their storage and processing. Currently, the draft standard passes the approval procedure in the ministries and departments of the Republic of Kazakhstan and is being prepared for registration procedure as the state standard of the Republic of Kazakhstan.

7.2 Kyrgyzstan

Regulation of the sphere of production and consumption waste management is carried out in accordance with the laws of the Kyrgyz Republic "On environmental protection", "On production and consumption waste", "General technical regulations for ensuring environmental safety", "On protection of atmospheric air", "On environmental expert examination", "On local self-government" and "On licensing and permitting system of the Kyrgyz Republic".

There is no definition for electronic and electrical waste in the national legislation.

The Law of the Kyrgyz Republic **"On production and consumption waste"**[70] is the basic law of the Kyrgyz Republic defining the state policy in the field of production and consumption waste management and regulating relations arising during the life cycle of waste, as well as public administration, supervision and control in the field of waste management. This Law defines the main principles of state policy in the field of waste management and the powers of state and local self-government bodies, regulates the requirements for waste management, transboundary movement of waste, licensing of waste management activities, state, industrial and public control, the regulation of waste management, governmental waste accounting and waste cadastre management, economic regulation and liability measures and dispute resolution procedure related to waste management.

According to the Law of the Kyrgyz Republic **"On licensing and permitting system in the Kyrgyz Republic"**[71]**,** transportation (including transboundary) of toxic waste, including radioactive waste (Article 15 para. 31) and disposal, storage, burial, destruction of toxic waste materials and substances, including radioactive substances (Article 16 para. 4); import and export of samples of ores and rocks, concentrates, production wastes and laboratory samples for analytical study (Article 17, para 4) in and from the Kyrgyz Republic shall be licensed activities. The license is issued on the basis of an expert opinion issued by an expert organization in accordance with the List of organizations of experts and licensors approved by the Resolution of the GKR as of March 12, 2015 # 115 "On approval of the lists of exported and imported specific goods subject to licensing".

Regulation of issues related to organization of activities in the field of production and consumption waste management, definition of requirements for waste disposal and facilities for waste disposal and the procedure for developing draft standards for waste generation are carried out in accordance with the **Procedure for management of production and consumption waste in the Kyrgyz Republic** (hereinafter referred to as the Procedure) approved by the Resolution of the Government of the KR as of August 5, 2015 # 559. This Procedure sets out the requirements for separate collection of waste to be used as secondary material resources and their recycling. In addition, the Procedure regulates in detail the norms of waste management. The regulation of waste management is carried out by developing standards for waste generation and setting limits related to placement of specific types of waste for a certain time at a specific waste disposal site within the territory of the enterprise and outside it. Draft standards for waste formation and setting limits for its disposal (WFNP) are developed for economic entities of hazard category 1 and take into account all types of waste generated at the site, that is, in product manufacturing, installation and (or) assembly of construction elements and equipment required for operation of buildings, for maintenance and (or) repair of instruments, equipment, machinery, vehicles and etc., maintenance and (or) repair of household products and items of personal use, office equipment and computers, activities related to analytical control, etc., as well as social infrastructure facilities. Thus, standard setting also includes electronic and electrical waste generated at the facilities of the first hazard category and justifies its proposed handling by use, neutralization, placement, and transfer to other economic entities for the purpose of its further use, neutralization and placement. However, this Procedure does not provide for separate requirements for prohibiting the disposal of WEEE at the landfills.

Regulation of legal relations concerning handling of hazardous waste and the operation of facilities dealing with disposal and burial of this type of waste is carried out in accordance with the **Procedure for Management of Hazardous Wastes in the Territory of the Kyrgyz Republic** approved by the Resolution of the Government of the KR as of December 28, 2015 # 885. This Procedure sets out the requirements for handling certain hazardous types of waste, such as: used packaging of chemicals, mercury-containing waste, used batteries and used oil products. The safety

[70] The Law of the Kyrgyz Republic # 89 as of November 13, 2001 "On production and consumption waste"
[71] The Law of the Kyrgyz Republic as of October 1, 2013 # 195 "On licensing and permitting system of the Kyrgyz Republic"

requirements for regulating the electrical and electronic equipment waste management as potentially hazardous waste are not specified in this document.

The requirements for classification of hazardous waste by hazard level and definition of the list of wastes, their characteristics and coding by the type of waste generating activity, physical method of handling and the aggregate state are regulated by **the Classification Code of Hazardous Wastes** approved by the Resolution of the Government of the KR # 9 as of January 15, 2010. In accordance with the above classifier, electronic and electrical waste can be classified as industrial as well as household waste by several of the following items:

Waste from the use of substances as solvents (excluding chemical substances):

- waste of electronic production (N140400/P00/Q 01/WM2/T2/C00/H00/D(R)00/A000).
- industrial wastes not otherwise specified in the classifier:
- transformers and capacitors containing polychlorinated benzenes or toluene, as well as polychlorinated biphenyls (N 160101/P 00/Q 06/WM7/T1/C58/H11/D(R) 00/RC010);
- other defective electronic equipment (N 160102/P 00/Q 06/WM7/T3/C00/H00/D(R) 00/GC020);
- other defective equipment (N 160103/P 00/Q 06/WM7/T3/C00/H00/D(R) 00/A000).

Waste of medical and veterinary services and research organizations:

- other written-off equipment (N 180307/P 00/Q 06/WM7/T3/C00/H00/D(R) 00/A000).

Household and trade-related waste:

- refrigerators (containing freons), individual component parts (N200301/P00/Q01+14/WS13/T4/ C00/H00/D(R) 00/G000);
- typewriters (N200302/P00/Q01+14/WS13/T4/ C00/H00/D(R) 00/G000);
- electronic equipment, individual component parts (N200303/P00/Q01+16/WS13/T4/ C00/H00/D(R) 00/GC020);
- fluorescent and other mercury-containing waste (N200318/P00/Q06/WS12//T1/ C26/H11/D(R) 00/AA100);
- batteries (N200500/P00/Q06/WS06/T3/ C00/H08+12/D(R) 00/AA180);
- led battery recharge waste (N200501/P00/Q06/WL01/T3/ C27/H08+12/D(R) 00/AA170);
- waste of acid batteries (N200502/P00/Q07/WS13/T0/ C18+23/H08+12/D(R) 00/A000);
- Batteries on Ni-Cr dry cells (N200503/P00/Q06/WS06/T0/ C23+40/H11+12+13/D(R) 00/G000);
- batteries on dry mercury cells (N200504/P00/Q06/WS06/T0/ C26/H6.1+11+12+13/D(R) 00/A000);
- other dry cell batteries (N200505/P00/Q06/WS06/T0/ C00/H08+11+12/D(R) 00/A000).

The order of the Minister of Health of the Kyrgyz Republic as of 13.08.2012 # 488 “On approval of guidelines “On the procedure for disposal of written-off medical equipment in healthcare facilities of the Kyrgyz Republic” determines the procedure for disposal of written-off medical equipment in health organizations of the Kyrgyz Republic.

In addition, the following interstate standards are effective in the Kyrgyz Republic adopted by Kyrgyzstandard as national standards:

- GOST 30772-2001 “Resource-saving. Waste management. Terms and Definitions”;
- GOST 30773-2001 “Resource-saving. Waste management. Stages of the technological cycle. Basic provisions”.
- GOST 30775-2001 “Resource-saving. Waste management. Classification, identification and coding of waste. Basic provisions”

These GOSTs define terms and definitions in the field of waste management and establish typical stages of the technological cycle of production and consumption waste, including liquidation of discarded, obsolete and / or decommissioned items (products) that have lost their consumer properties.

7.3 Tajikistan

The provisions regarding waste management are defined in a number of legislative acts of the Republic of Tajikistan: "On environmental protection" (2011), "On ensuring sanitary and epidemiological safety of the population" (2003), "On subsoil" (2010), "On licensing of certain types of activities" (2004), "On local government bodies" (2004), "On self-government bodies of settlements and villages" (2009), "On protection of consumers' rights" (2004), "On ensuring environmental safety of motor transport" (2015), "On technical regulation" (2009), "On food safety" (2012), the Land Code (2012), the Water Code (2012), the Forest Code (2011), the Code on Administrative Offenses (2008), the Criminal Code (1998), the Code of Administrative Offenses and other legislative acts.

The above laws regulate the relations arising in the process of formation, collection, storage, use, transportation, disposal and burial of waste; establish the concepts of standards for generation of production and consumption waste; powers of state management of this activity, supervision and control; determine the requirements and measures to protect land and water from pollution. The laws are aimed at preventing the negative impact of production and consumption waste on the environment and human health, involving it in the economic and production turnover as an additional source of raw materials.

Adoption of the Law of the Republic of Tajikistan (RT) **"On production and consumption waste"**[72] became a significant step in regulating relations in the sphere of waste management. The Law of the RT "On production and consumption waste" deals with the competence of the Government of the Republic of Tajikistan in the field of waste management, formation and implementation of state policy in the field of waste management, state supervision, development and implementation of targeted programs, adoption and approval of regulatory legal acts regulating legal relations to control their execution.

The Government of the Republic of Tajikistan has undertaken a number of measures for handling mercury waste. In 2009, the Government of the Republic of Tajikistan made a decision on widespread use of mercury energy-saving lamps in the country instead of conventional incandescent lamps. According to the data of the environmental protection authorities and the municipal unitary enterprise of housing and communal services "Manzilii kommunali", the reception centers for mercury-containing lamps should be created in all cities, districts and jamoats of the country. Although the decision of the Government of the Republic of Tajikistan on the need to recycle these lamps was adopted in 2011, the issue of demercurization of the already collected mercury lamps that have become unusable has not been resolved yet.

The Law of the Republic of Tajikistan "On production and consumption waste" 2002 #4: Particular attention should be paid to Article 4 of the Law of the RT "Waste as ownership subject": Waste producer shall acquire ownership rights to waste from the time of its formation and until this right is transferred to another person or until processing or complete disposal of waste in accordance with the procedure provided for by this Law. This article of the law establishes the ownership right of waste producer to its waste only before transferring it to others, which does not comply with the ERP methodology (Extended producer responsibility for waste management), which is effective in European countries and which is being introduced in CA countries.

Article 9 of the law provides for requirement to have a permit to handle waste, to introduce low-waste technologies, and to conduct waste inventories. One of the important points of Article 9: The operation of industries, in which hazardous waste is generated that is not disposed in an environmentally sound manner shall be prohibited.

Article 10 "Requirements for waste dumping" prohibits waste disposal in the territory of cities and other settlements, forest-park, health resorts, health-improving zones, watershed areas,

[72] The Law of the Republic of Tajikistan (RT) "On production and consumption waste" 2002, #4

groundwater fields used for domestic and drinking purposes, in areas of mineral deposits and mining operations.

Upon burial of waste it is mandatory to conduct monitoring of burial sites by the owner of waste disposal site in accordance with the procedure agreed upon with the authorized body in the field of waste management.

Article 11 "Requirements for removal of solid domestic waste from settlements" refers to the need for separate collection of valuable components (food waste, non-ferrous and ferrous metals, textiles, paper, glass and etc.), temporary storage, and regular removal and disposal of consumer waste. Cleaning of settlement area should be dealt with by the local government and comply with the requirements of sanitary regulations, hygiene and environmental standards.

Article 12. "Requirements for handling hazardous waste" provides for division of hazardous waste into classes according to their harmful effects on human health and the environment. Hazard class of waste is determined by the manufacturer in accordance with the regulations approved by the competent authorities in the field of waste management, sanitary-epidemiological, mining and technical supervision within their competence. Dumping of hazardous waste is allowed only in the facilities specially equipped for this purpose based on permits issued in accordance with established procedure.

Requirements for transportation of hazardous wastes, including transboundary movements, are provided in **articles 13 and 14**.

It should be noted that the Law of the RT "On production and consumption waste" does not distinguish the requirements regulating management of mercury, medical and electronic wastes that have a significant level of toxicity.

The Law of the RT "On licensing of certain types of activities" 2004, #5: Licensing of activities related to management of hazardous wastes is carried out in accordance with the Law of the Republic of Tajikistan "On licensing of certain types of activities". The types of activity subject to licensing include collection, use, neutralization, transportation and disposal of hazardous waste; operation of explosive, fire hazardous, chemically hazardous production facilities (**Article 17**).

The new version of the Regulation on the peculiarities of licensing of certain types of activities (**Chapter 31**) noted that the State Control Service for Use and Protection of Nature acts as licensing authority for collection, use, disposal, transportation and dumping of hazardous waste. Chapter 31 lists additional documents required for obtaining a license along with licensing requirements and conditions.

The Law of the RT **"On environmental monitoring"** 2011, # 147: The Law of the Republic of Tajikistan "On environmental monitoring" provides for conducting monitoring when handling hazardous waste.

The Law of the RT **"On protection of consumers' rights" 2004, No. 72**: The Law of the Republic of Tajikistan "On protection of consumers' rights" regulates relations between consumers and manufacturers, contractors, sellers upon sale of goods (works, services), establishes the rights of consumers to purchase goods (works, services) of due quality and safe for life and health, obtain the information about goods (works, services) and their manufacturers (performers, sellers), provides for state and public protection of consumers' interests, determines the mechanism for consumer rights implementation.

The law states that it shall be forbidden to include conditions in the contract that worsen and restrict the rights of consumer in comparison with that established by the legislation.

The manufacturer (executor) is obliged to establish the service life of a durable product (work), the expiry date of the goods, the warranty period for the goods (work), which after a certain period may pose a threat to life, health of the consumer, cause damage to his property or the environment.

Consumer rights to safety of goods (work, services):

- Sale of goods (performance of work, provision of services), including imported goods (work, services), without information on mandatory certification, and sanitary-epidemiological conclusion shall be prohibited.

- Information about goods (works, services) must necessarily contain indication of standards, the requirements of which the goods (works, services) must comply, registered (patented) trademark or service mark.

The Law of the RT "On ensuring sanitary and epidemiological security of the population", 2003, # 415: The Law of the Republic of Tajikistan "On ensuring sanitary and epidemiological security of the population" entrusts definition of sanitary norms and regulations and conducting sanitary and epidemiological control in places of centralized collection, use, decontamination, storage and disposal of production and consumption wastes to the Ministry of Health and Social Protection of the Population of Tajikistan.

Article 21. Industrial and domestic waste shall be collected, used, rendered harmless, transported, stored, buried, disposed under the conditions and by the methods that should be safe for human health and the environment and to be carried out in accordance with sanitary norms and regulations and other regulatory legal acts of the Republic of Tajikistan. In places of centralized collection, use, neutralization, storage and disposal of production and consumption wastes sanitary and epidemiological and radiation monitoring shall be carried out.

Article 27. Sanitary protection of the territory of the Republic of Tajikistan

Importation to the territory of the Republic of Tajikistan of dangerous goods and goods which import into the territory of the Republic is prohibited by law, as well as shipments and goods in respect of which, in the course of sanitary-quarantine control it has been established that their importation into the territory of the Republic of Tajikistan creates a threat of occurrence and spread of infectious diseases or mass non-infectious diseases (poisonings), shall be prohibited.

The European waste classifier is used to generate the municipal waste statistics in Tajikistan. The waste catalog of the European Union is used as a classifier for municipal waste.

Currently, in the country there is no system of state and departmental statistical recording and monitoring of data on volumes of waste generation, their composition, degree of influence on the environment and human health, as well as the use of types of production and consumption wastes as secondary raw materials. There is no official statistical reporting on hazardous waste in the republic. Statistical Agency abolished the forms of statistical reporting 14-SN (secondary resources) and 2-tp (waste) "Report on formation and storage of toxic waste".

7.4 Turkmenistan

During the years of independence, in Turkmenistan a number of measures were undertaken aimed at reducing the negative impact of solid domestic waste on the environment. At the legislative level **("The law on nature protection", the Sanitary Code, the Forest Code, the Water Code, the Land Code**), pollution of the environment with solid domestic waste is prohibited and its handling is regulated. Adoption of the Law of Turkmenistan "On waste" as of May 23, 2015 that regulates waste management is one of significant factors reducing formation of all waste in general.

In accordance with action plan for implementation of the State Program of the President of Turkmenistan "Health", the Ministry of Environmental Management developed a form of statistical reporting for industrial and domestic waste and "Instruction for the procedure for accounting of formation, use of industrial waste" according to Form No. 2 - industrial waste agreed with the Ministry of Health and Social Affairs and State Statistics Committee of Turkmenistan. The form was approved by the State Statistics Committee of Turkmenistan and introduced since 1998.

7.5 Uzbekistan

In accordance with **the Law of the Republic of Uzbekistan (RUz) "On waste" as of April 5, 2002, # 362-II**, it is stipulated that ownership right in relation to waste belongs to the owner of raw materials, materials, semi-finished products, other items or products, as well as goods (products) as a result of which use this waste has been formed. In addition, the law provides for the

obligations of waste owners, which include the need to ensure collection, proper storage and prevention of destruction and spoilage of wastes that have a resource value and to take measures for their disposal. According to **Article 24** of this Law, benefits are provided in accordance with the law to legal entities and individuals who develop and implement technologies aimed at reducing waste generation and disposal, create enterprises and facilities that produce equipment for waste disposal, participate in financing of waste management measures and reducing waste formation. The local governments may implement, within the limits of their competence, additional measures to stimulate the activities of waste utilization and reduction of waste formation.

At the same time, enterprises and organizations when discarding the electronic equipment should be guided by the order of the Ministry of Finance as of August 16, 2004, # 101 **"On approval of the Regulations on the procedure for writing off fixed assets from the balance sheet"**, which envisages entering in the books of unsuitable materials, non-ferrous and precious metals as secondary raw materials (scrap metal). At that, the parts, materials and precious metals of disassembled and dismantled fixed assets, which are suitable for repair of another fixed asset, are entered in the books in the corresponding accounts established by the liquidation commission. In the period until 2020, to stimulate proper disposal of electronic devices, electronic waste is taken free of charge from the individuals and public enterprises. This is despite the legislative norm, according to which the user must dispose used appliances and equipment by himself. From self-financing enterprises electronic waste is accepted on a contractual basis. At the same time, the plant if required, should not only arrange removal from the customer facility, but also dismantling.

"The program of joint activities of the State Committee for Nature Protection of the Republic of Uzbekistan and JSC "Toshrangmetzavod" on promoting the environmental activity of the population, implementing additional measures for environmental protection aimed at disposal of solid domestic and electronic waste in the Republic of Uzbekistan for the period 2016-2020" includes the following measures:

- installation of specialized containers for reception of batteries and unserviceable household appliances from the population in points of sale of new home appliances;
- organization of reception points in places of mass gathering;
- installation of informational thematic boards to ensure rising awareness of the public regarding proper disposal of electronic waste .

According to **Article 99 of the Law of the RUz "On water and water use" as of May 6, 1993 # 837-XII:**

The enterprises, organizations and the individuals shall be prohibited to:

– discharge industrial, domestic and other types of waste and garbage to water bodies;

– pollute and contaminate water bodies by spillage of oils, with wood, chemical, oil and other products;

– pollute and contaminate the surface of spillways, ice cover, reservoirs and the surface of glaciers by industrial, household waste, garbage and emissions, as well as with oil and chemical products, which washing will cause deterioration of surface and groundwater quality;

– pollute water with fertilizers, pesticides and other harmful substances.

Article 19 of the Law of the Republic of Uzbekistan "On protection of atmospheric air" as of December 27, 1996, # 353-I obliges the enterprises, institutions and organizations that operate and repair products containing ozone-depleting substances to ensure their accounting and replacement with ozone-friendly substances.

According to **Article 21** of the same law "It shall be prohibited to dump man-made formations that may be sources of air pollution or other harmful effects in the territory or near settlements.

Production and consumption waste, which are sources of air pollution, shall be subject to processing, cleaning, deodorization or storage at special sites, which location is determined by the local governments in coordination with the Ministry of Health of the Republic of Uzbekistan upon availability of positive conclusion of the state environmental expert examination".

The Resolution of the Cabinet of Ministers "On approval of the rules for provision of communal services" as of July 15, 2014 # 194, Annex 3:

Paragraph 22, part III Local governments, contractor shall:

– take measures to develop and introduce technologies for disposal of solid and liquid household waste, which they own;

– not allow mixing of wastes specified in paragraph 24, except for cases prescribed by the production technology;

– not allow storage, recycling, disposal and burial of waste in unauthorized places or facilities;

– carry out monitoring of sanitary and environmental condition of own waste disposal facilities;

– carry out works on reclamation of disturbed land plots when handling solid and liquid domestic waste;

– implement a set of measures aimed at maximum utilization of waste, sale or transfer to other legal entities of individuals engaged in collection, storage and disposal of waste, as well as ensure environmentally safe burial of waste not subject to disposal.

Industrial enterprises (domestic manufacturers) shall be obliged to accept the obsolete and unserviceable products of their own production from users for subsequent disposal at the expense of the manufacturer, having developed a special mechanism for receiving these products.

Paragraph 24, **part IV** Primary sorting of solid domestic waste shall refer to the following types:

1) plastic;
2) metal waste;
3) paper waste;
4) biowaste and other types of waste that can not be recycled and utilized

Paragraph 25, part IV. Consumers of mercury-containing lamps that use them for lighting shall accumulate unserviceable mercury-containing lamps separately from other types of waste in a specially designated place.

Accumulation of unserviceable mercury-containing lamps shall be carried out in a special container that excludes damage to lamps and emission of mercury substances contained in them into the air, water supply sources, soil and foodstuffs, and then shall be stored in specially installed containers at domestic waste disposal facilities of the contractor. With response method of domestic waste removal the contractor shall collects mercury-containing lamps ensuring their separate and safe placement in a special vehicle.

Transportation of unserviceable mercury-containing lamps accumulated in waste collection points before disposal shall be carried out by the contractor and the recycling company.

The procedure for storage, stock-keeping, transportation and disposal of mercury-containing lamps and devices, as well as used oils in the Republic is regulated by:

- The Resolution of the Cabinet of Ministers # 405 as of October 23, 2000. "On streamlining the operation of enterprises engaged in use and disposal of mercury-containing lamps and devices";
- The Resolution of the Cabinet of Ministers # 266 as of September 21, 2011 "On approval of the Regulations for organization of collection and disposal of unserviceable mercury-containing lams";
- The Resolution of the Cabinet of Ministers # 258 as of September 4, 2012 "On approval of the Regulations on the procedure for returning, collection, settlement, storage and transportation of waste industrial oils";
- The Resolution of the Cabinet of Ministers # 295 as of October 27, 2014 "On approval of the Regulations on the procedure for state accounting and control in the field of waste management".

At the same time, the issue of electronic waste recycling is not regulated by current legislation.

7.6 Legislation of the EAEU

Since Kazakhstan and Kyrgyzstan are members of the EAEU, this chapter examines regulatory legal acts related to the regulation of electrical and electronic equipment waste in the Union.

Adoption by the decision of the Council of the Eurasian Economic Commission of the technical regulation as of October 18, 2016 "On restriction of use of hazardous substances in electrical and radio electronic products" TR EAEU 037, which comes into force on March 1, 2018, is one of important steps taken in the EAEU aimed at protecting human health and environment. This regulation will be effective in the EAEU countries, including Kazakhstan and Kyrgyzstan.

In accordance with the requirements of TR EAEU 037/2016,
"the product of electrical engineering and radio electronics should be designed and manufactured in a way not to contain led, mercury, cadmium, hexavalent chromium, polybrominated biphenyls and polybrominated diphenyl ethers". In homogeneous materials used upon manufacturing of equipment, the concentration of these substances "in weight percent should not exceed 0.1, and 0. 01 of hexavalent chromium".

Many goods both produced in the territory of the EAEU, and imported from other countries are subject to these rules. They include, for example, equipment for cooking and food storing, equipment for washing, ironing, drying, cleaning clothes items. In addition, electronic computers and devices connected to them (servers, system blocks of personal computers, laptops, ipads). The regulation applies to telecommunication facilities, including stationary and mobile phones, electrical office equipment. The use of harmful substances is also limited in light equipment, electronic musical instruments, cash registers, ticket printing machines, ATMs, fire and security detectors. Electric toys for children under the age of 14 are also included in the scope of this technical regulation.

Transitional period is required to ensure entering into force of the regulation. This is necessary to ensure change of production technologies by businesses. In this case, the period is from October 18, 2016, i.e. from the moment of signing the act, until March 1, 2020.

This technical regulation contains Annex 3 "Specific requirements for limiting the use of hazardous substances in products of electrical engineering and radio electronics". This list, in particular, includes special requirements for mercury content in general lighting lamps. For example, mercury content of 3.5 mg in tubes of 30 to 50 W will not be limited.

It should be noted that according to the Minamata Mercury Convention, the products containing mercury and subject to phased withdrawal from circulation until 2020 include most switches and relays; CFL (compact fluorescent lamps) of 30 or less watts containing more than 5 mg of mercury per unit (an unusually high amount); tubular fluorescent lamps - tubular lamps with a capacity of less than 60 watts with a mercury content of more than 5 mg and lamps with a halophosphate phosphor of less than 40 watts with mercury content exceeding 10 mg; high-pressure mercury lamps; mercury in various cold cathode fluorescent lamps and lamps with an external electrode. In Annex 1 to this document the "Reference on technical regulations of the Eurasian Economic Union "On restriction of the use of hazardous substances in electrical and radio electronic products" is provided, which will allow examining the provisions of this technical regulation in more details.

In addition, within the framework of the Decision of the Board of the Eurasian Economic Commission as of April 21, 2015 #. 30 "On measures of non-tariff regulation" in relation to third countries, the Single list of goods has been approved, which includes hazardous wastes prohibited for importation and hazardous wastes, to which non-tariff regulation measures are applied in trade with third countries.

8 Stakeholder assessment

8.1 Stakeholder review

Assessment of stakeholders in the field of electronic waste management was carried out only in two countries of the Central Asian region: Kyrgyzstan and Tajikistan. As it was noted in Section 3.2., collection of the information was carried out in several ways: questionnaires, interviews, personal meetings, in-depth interviews and based on the observations of experts in the areas of distribution and repair of electrical and electronic equipment.

The study covered the following stakeholder groups:

- importers;
- distributors;
- consumers;
- repairmen;
- existing official recyclers of electronic waste;
- informal processors of electronic waste;
- representatives of state authorities.

First of all, it should be noted that a significant number of respondents, including corporate, institutional organizations, importers, processors, electronic equipment repairers, refused to answer questions and take part in the interviews. This is certainly related to presence of significant share of shadow economy, both in import and in trade of electronic and electrical goods, as well as in their subsequent informal processing and disposal. In Kyrgyzstan and Tajikistan there is an informal "black market" for purchase and sale of electronic equipment, mainly mobile phones, audio and video equipment, home appliances, office equipment and electrical appliances. Prices for these items are quite spontaneous, in most cases they are established based on negotiation.

Part of respondents who were favorably disposed towards the questionnaires and agreed to answer questions, confirmed that they knew about the environmental hazards caused by discarded electronic equipment, about possible electronic waste recycling, noting that the situation in the country in terms of e-waste management had not been established yet and required organization and improvement in accordance with international standards.

The results of the work done during the survey, interviews and personal meetings are given below.

8.2 Manufacturers and importers

There are no manufacturers of consumer electronics in Kyrgyzstan and Tajikistan. Both countries import electrical and electronic equipment. Household appliances are mostly delivered in small batches from China, Russia and other countries.

8.3 Distributors

In **Kyrgyzstan**, 3 large distributors of household appliances - stores *Eldorado, Tekhnodom, Sulpaq* - took part in the survey in the city of Bishkek, the Kyrgyz Republic. These companies are retailers of electronic equipment, large and small household appliances. *Technodom* and *Sulpaq* are certified according to ISO 14001. All three companies are branches of Kazakhstani firms. Due to the fact that the head offices of the companies are located in Kazakhstan, branch administrations did not provide the information regarding sales volumes, company strategies in the field of proper management of electronic waste, arguing that they were not competent in these matters and this was the prerogative of the management that is located in Kazakhstan.

At the time of the survey, the *Eldorado* store held promotion action from March 3 to 31, 2017: a buyer who has handed over old equipment to the *Eldorado* store gets an opportunity to purchase a certain new product at a discount. The seller undertook obligations to take out used equipment from the buyer. According to sellers, few people took part in the action. The company *PromTechnoResursKZ,* which is one of officially operating enterprises for complex utilization of used electrical and electronic equipment that lost its consumer properties in Almaty (Kazakhstan) carried out recycling and export from the country[73].

In **Tajikistan**, it was impossible to obtain the information from distributors of electronic equipment as they refused to participate in the survey and in the interviews.

8.4 Consumers

8.4.1 Private consumers

22 households in Dushanbe and 30 households in Bishkek have been surveyed. The interviewed persons were household members.

Kyrgyzstan

1. In Bishkek, 30 households participated in the survey. The average household size is 4 members with an income level of 200 to 500 USD per month. During the survey, 93% of respondents noted that they were aware of hazardous properties of some components of electronic waste. At the same time, only 10% said that waste collectors came to them, 2 of them noted that they personally handed over used equipment (refrigerator, vacuum cleaner) to the collectors.

2. The number of units of electrical and electronic equipment in households:
   - the main types of large household appliances are available in all households. There are 43 refrigerators per 30 households; 11 air conditioners; 37 washing machines; 32 electric and gas cookers.
   - all households are equipped with small household appliances: irons - 35 pcs .; electric kettles - 17 pcs; microwave ovens - 26 pcs; vacuum cleaners - 31 pcs; a large number of cables and extension cables, other types of small household appliances from 3 to 6 pieces per household.
   - household are not evenly provided with equipment of category 3. Each household has 1 to 6 mobile phones. In total, there are 48 mobile phones per 30 households; 8 laptops; 23 personal computers; 27 cathode-ray tube monitors and liquid crystal monitors; 13 printers.
   - household appliances of category4 are available in all households. On average, one household has 1.2 TV sets (flat panel); 0.7 DVD players; 0.3-0.5 other types of equipment.
   - all households are equipped with lighting devices. Most of them are switching to the use of energy-saving lamps (fluorescent, LED). On average, one household has between 15 and 32 electric lamps.
   - 74% of respondents have batteries.

3. Ways of acquiring and handling equipment that lost its consumer properties:
   - all respondents answered that in 89% of cases they bought new equipment in stores, 11% of equipment was received as a gift, 60% of which was new equipment and 40% used, but still working equipment. Large-size equipment is used until its breakdown and when repairs are no longer profitable.
   - At the end of its service life the equipment is dumped in 70% of cases together with other waste, in 20% of cases it is stored at home and in 10% of cases this equipment is given to a friend.

4. 9 % of respondents reported that they would give their e-waste for free.

[73] http://tresurs.kz/

Tajikistan

22 households took part in the survey in Dushanbe. The average household size is 3-7 members per household with an income level of 200 to 500 USD per month.

1. Most urban residents are informed of hazardous components of electronic waste. 100% of respondents noted that collection of electronic waste in any form was not carried out.
2. The number of units of electrical and electronic equipment in households:
   - all households have large household appliances of category 1: refrigerators, air conditioners, washing machines, electric heaters, electric or gas stoves;
   - practically all households have small household appliances of category 2 (except for popcorn machines, electric lawnmowers). 3 households have water dispensers, 5 households have soldering irons;
   - IT and telecommunications equipment (Category 3). System units, LCD monitors, laptops, mobile, fixed phones, modems are available in 70% of households. Households do not have copying machines, fax machines, scanners, printers;
   - household appliances (Category 4). All respondents have TV sets (flat panel), DVD players, cameras, tape recorders. Some households have several TVs, DVD players. There are no videocassette tape recorders;
   - lighting equipment (Category 5). Interviewed households are equipped with all kinds of lighting equipment.
3. Ways of acquisition and handling equipment that lost its consumer properties:
   - 60% of equipment is bought in trade centers, household appliances stores, dealer centers, 40% of respondents purchase used equipment through online ads, secondary market or get as a gift.
   - In most cases electronic products are used from 2 to 10 years, until the time of its breakdown and when repairs are no longer profitable. Respondents noted that after buying new equipment, they sold old equipment through the secondary market, gave, threw out, put in garbage containers, stored at home. At the same time, all respondents noted that they agreed to give their electronic waste to waste collectors for free.

8.4.2 Corporate and institutional consumers

Kyrgyzstan

17 organizations in Bishkek: state organizations, commercial and non-profit organizations participated in the survey.

1. All respondents are quite well informed about the dangers of electronic waste and that there are ways to dispose it. But the respondents are not aware of policy or strategy for electronic waste management existing in their organization. In 14 out of 17 organizations, inventory of existing equipment is carried out.
2. Availability of electrical and electronic equipment in organizations:
   - All organizations are equipped with IT and telecommunications equipment. 97% of the employees have either personal computer, or laptop, or both, depending on their position. On average, there are 1 copy machine, scanner, printer for 10 employees.
   - Each organization has from 1 to 3 refrigerators and from 3 to 7 air conditioners.
   - Most often small appliances in the organization include microwave ovens and water dispensers.
   - household appliances of category 4 include TVs and video projectors in 60% of organizations.
3. All organizations purchase new equipment in stores. Average service life is from 4 to 8 years. Electrical and electronic equipment that is no longer used is either stored in warehouses, or sold to individuals or donated for charitable purposes.

4. The main obstacles to proper electronic waste management in the country, according to respondents, are as follows:

- lack of required infrastructure;
- lack of legislation on recycling;
- lack of e-waste collection system.

Organizations are not prepared to incur additional financial expenses for collection and processing of electronic waste.

Tajikistan

13 organizations have been surveyed in Dushanbe: non-governmental organizations, organizations working in the field of information and communication technologies, 1 branch of Agroinvestbank, stock exchange, administration of the *Tajiktextil* organization, administration of the *Tajikinvest* organization.

1. All respondents are well aware about the dangers of electronic waste and the available ways for its disposal. Respondents find it difficult to answer the question about presence of a policy or strategy for e-waste management in their company.
2. Availability of electrical and electronic equipment in organizations:
   - all organizations are equipped with large household appliances of category 1: refrigerators, air conditioners, electric heaters.
   - practically all organizations have small household appliances from category 2, including water dispensers, kettles, some organizations have microwave ovens.
   - IT and telecommunications equipment (Category 3). All organizations have system units, liquid crystal monitors, laptops, mobile, fixed phones, modems, copiers, scanners, printers. Some have fax machines.
   - organizations have domestic appliances of category 4, including TVs (flat panel), DVD players, cameras, video projectors.
   - surveyed organizations are equipped with all kinds of lighting equipment included in category 5.
3. Corporate and institutional consumers in 80% of cases buy new equipment in trade centers, household appliances stores; branches receive equipment centrally from their parent organizations. Used equipment is purchased in 20% of cases.

The average service life of the equipment is from 4 to 10 years or until it breaks. After the end of service period, equipment is sold through tenders, written-off, given to metal scrap collectors, stored in warehouses or taken to a dump.

4. All respondents noted that they agreed to give their electronic waste to waste collectors for free. But organizations are not ready to pay for collection and processing.

The respondents reported that the main obstacles to proper management of electronic waste include the lack of public policies for e-waste management, infrastructure, legislation, collection and processing systems. To address these problems, the following measures were proposed: establishment of centers for e-waste collection and utilization, stimulation of public policy on e-waste management. So far, there is only a spontaneous process of e-waste utilization in the country.

8.5 Collectors

Kyrgyzstan

Large trade centers engaged in sale of household appliances periodically hold actions to collect used equipment. The collected equipment is transported to Kazakhstan for further processing and disposal.

In Bishkek, people who collect electronic equipment unofficially refused to fill in the questionnaires. So, the experts conducted verbal interviews. According to the respondents in Bishkek, there are two types of used electronic equipment collection:

1. Collection of unserviceable equipment for extraction of non-ferrous and ferrous metals. Basically, people are engaged in this activity on informal basis. For this work, a group of 3-5 people is formed, most common work place is a private house or a garage. The collectors drive cars with announcements about collection of such old equipment as refrigerators, washing machines, batteries and other large-sized household appliances. Collectors buy waste at a negotiated price.
2. Collection of used and operable electronic equipment for resale. Recently, this type of activity has reached the official level, specialized points of reception and sale of used equipment have been opened. Such companies give ads in newspapers and online. Collectors buy used equipment at a negotiated price.

Tajikistan

Four people engaged in e-waste collection have been surveyed.

Representatives of small businesses are collectors of electronic waste. Organizations, private companies, suppliers and the public are interested in collecting electronic waste. Ads on sale of obsolete equipment, closure of companies, liquidation of private tenants serve to inform about the availability of used electronic equipment. In addition, collectors place ads in the press about collection of obsolete equipment from people.

Private companies and tenants are one of important sources of e-waste collection due to the fact that the need for paperwork and time for documents preparation is much less compared to that of state or large and known organizations.

Collectors who took part in the survey noted that they periodically cooperated with large private companies that collect waste officially, i.e., under license.

Personal cars or taxi are used to collect waste.

According to the respondents, the main obstacles to proper collection of e-waste are as follows:

- competition among collectors;
- criminal items collected;
- inflation;
- limited information about sale of such equipment.

Table 20

Electrical and electronic products subject to collection and recycling

Product	Places of collection	Payment / fee collected	Price (please, indicate a unit)
Note: Tajik somoni – 0.12$			
Used plastic disposable batteries		Payment in cash	1 kg / 2-3 somoni (sometimes for free)
Disposable batteries, black with electrolyte		Payment in cash	
Led from batteries		Payment in cash	1 kg / 10-15 somoni
UPC (1-10 kW) **- transformer** **- case** **- copper winding** **- PCB**		Payment in cash	Iron, 1 kg / 50 dirams (0.5 somoni) Copper, 1 kg / 30 somoni
Motors (burned)		Payment in cash	10-30 somoni

Product	Places of collection	Payment / fee collected	Price (please, indicate a unit)
Note: Tajik somoni – 0.12$			
Transformers (burned)		Payment in cash	40-50 somoni
TV sets (burned)		Payment in cash	40-50 somoni
Fridges (burned)	Found in the markets, in the backyards	Payment in cash	50-60 somoni
Gas stoves (burned)	Found in the markets, in the backyards	Payment in cash	50-60 somoni
Air conditioners (burned)	Ads on sale	Payment in cash	40-80 somoni

8.6 Repairmen

Kyrgyzstan

The representatives of 4 repair shops for household appliances were interviewed in Bishkek. The respondents refused to provide their contact information. The legal status of the shops include individual entrepreneurs (IP), limited liability companies (LLCs) or service persons who work on informal basis. From 3 to 5 people work in the shops. The interviewed shops are not certified according to ISO 14001. All respondents know what is electronic waste.

Repair shops for household appliances do not collect electronic waste. Consumers bring broken electrical appliances to the shops or book a service call. The shops that participated in the survey do not cooperate with other companies.

Depending on resources of the shops and the type of equipment breakdown, 15 to 50 pieces of equipment per month are subject to repair on average. The cost of a call for diagnostics in the city is 200 soms[74]. The cost of refrigerator repair ranges from 500 soms to 3500 soms, washing machines - from 500 soms to 3000 soms. The cost of small household appliances repair depends on device model and the type of failure. Components of equipment or equipment that can not be repaired and not suitable for further use are stored in the warehouse or dumped together with other garbage into containers for regular household waste.

According to the respondents, for proper e-waste management it is necessary to develop the relevant regulations and to establish collection points.

Tajikistan

In Dushanbe, 7 repair shops for home appliances have been surveyed.

According to the respondents, the following types of electronic products are repaired: TV sets, refrigerators, radio tape recorders, vacuum cleaners, tape recorders, microwave ovens, satellite receivers, electric kettles, radio devices, washing machines, printers, modems, monitors and etc.

In the shops for repair of household appliances on average from 2 to 4 people are working. Depending on the technical resources of the repair shops, from 1 to 10 units of large household appliances and from 5 to 50 units of medium and small household appliances are repaired per month. The average price for repair of large household appliances is set from 100 to 400 Tajik somoni[75], and from 20 to 200 somoni for small household appliances. Repair shops do not deal with buying up broken equipment and selling repaired products; repaired equipment is returned to the owner. Those parts or products that can not be used for repair or refurbishment are stored in warehouses or are dumped as garbage to a landfill.

In Tajikistan, the following entities are engaged in repair of household appliances:

[74] Kyrgyz som = 0.68 $

[75] Tajik somoni = 0.12 USD

- official shops under the organizations;
- private companies;
- informal shops.

The repair shops interviewed are not members of the associations or processing authority. However, official shops cooperate with other city repair shops.

The respondents mentioned the following obstacles to proper disposal of electronic waste:

- lack of governmental support;
- insufficient financing of repair shops;
- difficulties related to obtaining license and etc.

According to repairmen, for proper e-waste management it is necessary to establish a system for collecting this type of waste.

8.7 Recyclers

In **Kyrgyzstan**, there is only one company that specializes in electronic waste recycling and has a license for this type of activity. According to the owner, the company is experiencing difficulties in providing the enterprise with raw materials, i.e. electronic waste, since the bulk of waste is bought up by shadow business.

On February 13, 2013, the Government adopted the Resolution # 70, which grants the rights and opportunities to the national industrial enterprises to independently carry out counter delivery and collection of scrap and waste of non-ferrous and ferrous metals (bypassing the State Enterprise Temir) for their technological needs and production. After adoption of this Resolution, 11 companies appeared in the market that use scrap and waste of ferrous metals as raw materials in their production process.

Recyclers from shadow business collect significant amount of electronic waste and extract non-ferrous and ferrous metals. Sorted scrap is sold to companies that have permission to collect, purchase, recycle and sell scrap and waste of non-ferrous and ferrous metals. Plastic component from these products is dumped, since plastic from office equipment has many small metal parts incorporated into plastic.

During the survey, a visual inspection was carried out of one of battery collection points located in private sector of Bishkek, which is a territory of the former motor depot. Copper, brass, and aluminum are also received here. Judging on visual assessment this facility employs about 15 people.

Photo 1. Location of battery collection point

Photo 2. Battery collection point: “stockpiling” of waste

Photo 3. Battery collection point: “storage” of waste

When visiting the above mentioned battery collection point and other e-waste reception points, and also at contacts by phone, nobody agreed to show where and how the received waste is stored, and also what is done with this waste. However, it was found that acid from batteries, oils from car parts and other reagents are just spilled to the ground in this sites. Contaminants are not found in groundwater. Direct contact and access by private persons to these sites occurs at delivery of metal scrap making it difficult to provide the exact estimation.

Currently in the Kyrgyz Republic 20 companies are engaged in purchase of metals, including Chinese, Pakistani and Indian companies. Of the total number of companies operating in the market, there are about 8 companies with Chinese capital. The price for 1 kg of ferrous metal scrap is 5 som; the price per 1 kg of non-ferrous metal scrap varies from 40 soms to 350 soms.

As noted above, the equipment that lost its consumer properties collected in large trade centers, such as *Eldorado*, for example, is exported to Kazakhstan for further processing and recycling by the company *PromTekhnoResursKZ*.

Export of non-ferrous and ferrous metals scrap in Kyrgyzstan is poorly regulated. Uncontrolled export of such raw materials outside the republic by legal entities and individuals has grown, since the demand for it is huge and the price is high. Some survey participants reported about shadow export of not only scrap of non-ferrous and ferrous metals, but also about shadow export of electronic waste for processing to China. In turn, this affects sector of recycling of this type of raw materials in the country.

There is no information about recyclers in **Tajikistan** due to the absence of any official data.

8.8 End utilizers

Electrical and electronic equipment waste of private and corporate consumers, also partially recycled after informal processors, eventually is thrown into waste containers along with other waste, since there is no system of organized collection of secondary raw materials.

The municipal enterprise (ME) *Tazalyk* renders municipal services related to sanitary cleaning of Bishkek area, including collection and removal of solid domestic waste at the expense of the population and business entities of the capital. It provides the following types of services: rendering paid services to individuals and legal entities on a contractual basis, in accordance with current legislation of the Kyrgyz Republic, which includes collection and removal of solid domestic waste and motor vehicle services.

At the moment, ME *Tazalyk* is a monopolist in the field of collection and dumping of solid waste in the city of Bishkek. The market share of ME *Tazalyk* in commercial segment is 87.0%, and 92.1% in providing services to the individuals. At present, SDW of Bishkek is transported to the city's single active landfill. At the moment, there is no sorting of waste by formal segment participants. Informal sorting of waste is carried out at various stages of the supply chain of materials, from skips to a municipal landfill.

About 1.5 million m^3 of solid domestic waste is generated in the city annually, which is 220,000 tons. Informal waste collectors select some part of valuable waste fractions in the skips, but the waste collected by the municipal trucks still contains 28% of valuable fractions: 1% of metal, 1% of textile, 8% of plastic, 8% of glass, 10% of waste paper, 22% of other waste and 49 % of organic components.

Thus, the bulk of electronic waste in Bishkek, along with other types of waste gets to municipal landfill because of the lack of an appropriate legislative framework regulating electronic waste management, as well as incentives for establishing recycling sector.

8.9 Most affected communities

In this paragraph, only the situation in Kyrgyzstan is considered since there is no information for Tajikistan.

Among the communities at risk, as a result of the lack of proper electronic waste management, three most vulnerable groups have been identified in Kyrgyzstan:

1. workers in illegal enterprises for collection and processing of electronic waste;
2. people below the poverty line and seeking their livelihood at the landfill of Bishkek;
3. domestic producers that use scrap of non-ferrous and ferrous metals in their production.

1. **Workers.** Since a large share of collection and processing of electronic and electrical waste is carried out informally, in an artisanal way, then sanitary, environmental and labor requirements and standards are not observed.

For example, during informal visit to the point of collection and processing of ferrous and non-ferrous metals in the residential sector it was found that liquid reagents containing in broken electronic equipment are just poured out on the ground.

According to the media, local residents living near Chinese artisan enterprises processing non-ferrous scrap metal in the Chui oblast of Kyrgyzstan complained that their health deteriorated as a result of their activities. According to the environmental conclusion, in the course of production activities, harmful substances such as carbon monoxide, nitric oxide, manganese and its oxides, welding aerosol, hydrogen fluoride are emitted at these enterprises. This causes skin itching, coughing, choking and lacrimation[76].

"When we visited these enterprises, we found serious violations of safety rules; there were about 45 workers with complete disregard for safety of the facility. Workers who were mostly residents of the nearby villages work with molten metal for 700 soms per month inhaling harmful vapors. At the same time they do not even have boots to protect their bare feet, there are no respirators. No deductions are made to the Social Fund" – reported the representatives of Public Association *Taza Tabigat*[77].

2. **People below poverty line.** As noted above, most of the e-waste, which is potentially hazardous waste, eventually gets to municipal landfill. Every day people in search of income come to this landfill, while some of them live in the immediate vicinity of the landfill in illegally built new buildings.

In December 2015, within the framework of the project "Solid Waste Management System Improvement in Bishkek" of the European Bank for Reconstruction and Development (EBRD), a program of foreign consultants was launched in Bishkek to identify problems in the sphere of illegal labor - the social mobile unit (SMU). According to the results of their study it was found that 512 socially vulnerable Kyrgyz citizens work in Bishkek landfill. "Waste is sorted by 328 men and 184 women. The workers include children and pensioners. For example, about 20 employees are minors and 27 employees are older than 55 years. Among them there are Bishkek residents127, 63 residents of Chui oblast, others came from other oblasts: 107 - from Jalal-Abad oblast, 51 - from Naryn, 25 - from Batken, 18 - from Issyk-Kul, 7 - from Talas, and seven have no official registration. These people do not have access to education and health care".[78]

3. **Domestic producers**. Since processing of ferrous and non-ferrous metals scrap is poorly regulated, the problem arises of uncontrolled export of scrap of non-ferrous and ferrous metals from the Kyrgyz Republic, which creates a deficit for domestic consumers of secondary materials.

8.10 Civil society. Other stakeholders

This section provides the list of some international projects that have been or are being implemented in close cooperation with civil society of Kyrgyzstan and are relevant to improving the situation in the country in the field of waste management, including electrical and electronic equipment waste.

1. UNDP, in the framework of low-carbon "green" development, supported SAEPF in development and promotion of a number of waste management documents, including:

- draft strategy of domestic waste management in the Kyrgyz Republic and its implementation plan;
- regulations for plastic waste management, which was officially submitted by SAEPF for coordination to ministries and agencies;

[76] http://www.vb.kg/doc/191071_liteynyy_ceh_ne_daet_dyshat_jiteliam_kanta.html

[77] http://knews.kg/2012/05/v-kyirgyizstane-obnarujenyi-desyatki-nelegalnyih-kitayskih-liteynyih-tsehov/

[78] http://www.vb.kg/doc/337820_stroit_mysornyy_zavod_i_poligon_nachnyt_primerno_cherez_polgoda.html

- Program and plan for proper management of chemical substances in the Kyrgyz Republic[79].

2. UNDP project "Management of PCBs (polychlorinated biphenyls) in Kyrgyzstan" carried out an inventory of equipment and wastes containing PCBs. Financial resources were provided to replace old equipment containing PCBs; laboratories were equipped.

3. GEF-UNDP project "Protection of human health and the environment from unintentional releases of persistent organic pollutants and mercury as a result of improper handling of medical waste in Kyrgyzstan" Кыргызстане»[80]. Work has been carried out to improve the situation in the field of medical waste management, including used medical equipment.

4. In 2016, the European Bank for Reconstruction and Development (EBRD) approved a project to improve solid waste management system in Bishkek and allocated 22 million euros for its implementation. Part of the money will be directed to technical equipment of the municipal enterprise *Tazalyk*, and another part - to solve problems with waste disposal, including the reclamation of the landfill. It is planned to locate waste sorting plant in the new landfill.

5. Within the framework of activities of the Commonwealth of Independent States (CIS), a project is being considered to organize electrical and electronic equipment waste management system. The project was initiated by the UNIDO Center for International Trade Cooperation in the Russian Federation. Kyrgyzstan will take an active part in this project implementation. Within the framework of this work, draft Agreement on cooperation of the CIS member states in the field of electronic and electrical equipment waste management was approved[81].

6. In 2017, the NGO *The Independent Environmental Expertise*, in close cooperation with state bodies and independent experts, implemented the project "Improving and strengthening the legislative framework for effective management of electrical and electronic waste in the Kyrgyz Republic" with the support of UNEP. The study was conducted based on review of international experience in effective management of electrical and electronic waste, various analytical studies, available developments within the framework of national legislation and expert analysis aimed at identifying opportunities to introduce the best international practices in the country. In addition, within the framework of this project, draft regulatory acts were developed aimed at creating a system for regulating electronic waste in the country.

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[79] http://nature.gov.kg/index.php?option=com_content&view=article&id=686%3A2014-09-22-09-26-24&catid=34%3A2009-01-28-16-47-09&Itemid=69&lang=ru

[80] http://www.kg.undp.org

[81] Minutes of the expert group meeting of the CIS member states as of June 29-30, 2017.

9 Mass flow assessment

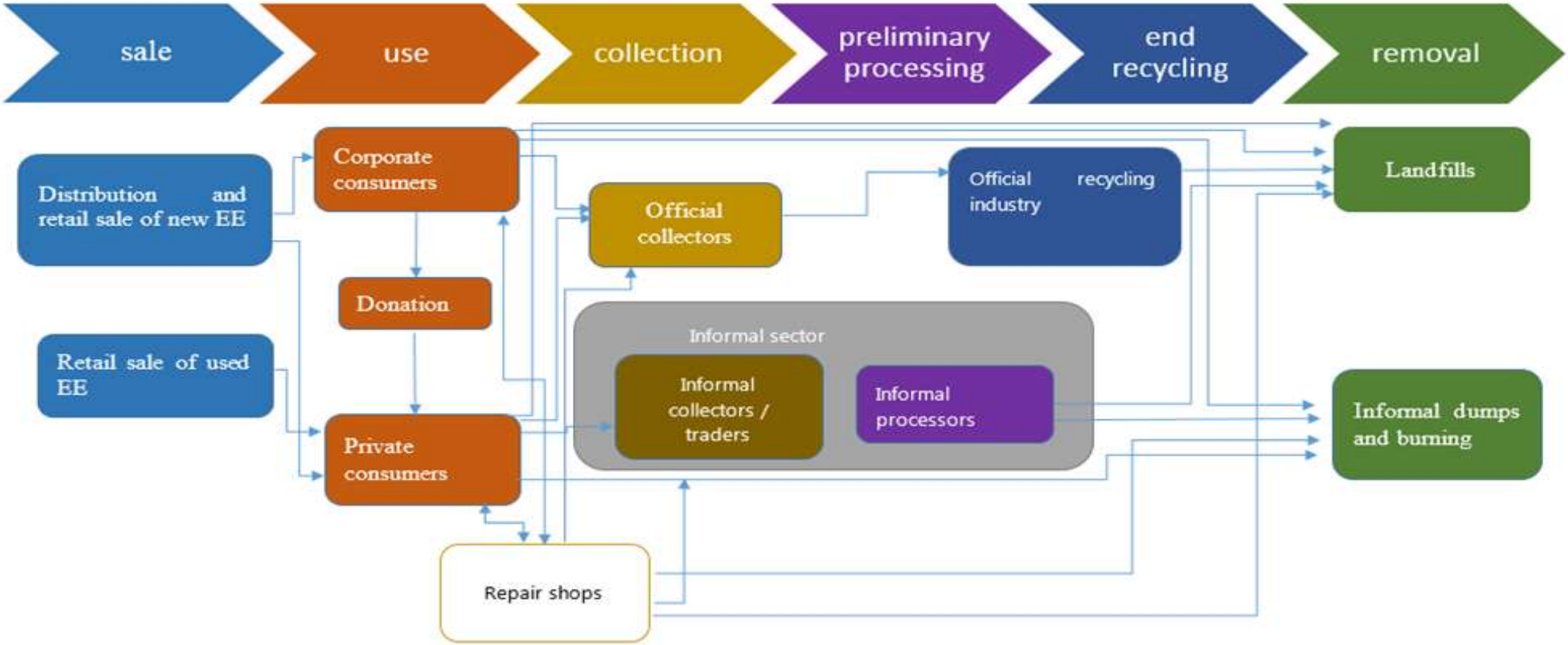
9.1 Scheme of mass flow system

Based on stakeholder assessment results, mass flow system in Kyrgyzstan was developed, which is presented below.

Figure 1

Scheme of mass flow system in Kyrgyzstan

Various entities in the system are represented by rectangular boxes, and electronic waste flows are shown with blue arrows.



9.2 Existing mass flows

Existing mass flows were calculated using two methods: "Market sales" and "Acquisition and use". These methods are described in detail in Section 3.3. The results obtained are presented below.

"Market sales" method

Imports and exports data

For calculations according to this method, the volumes of imported and exported products presented on the TRADE MAP website have been used: "Trade statistics for development of international business. Monthly, quarterly and annual trade data. Import and export, volumes, growth rates, market share, etc.[82] Values of export and import volumes of selected types of products for each country under review are presented in Annexes 1-5 to this document.

Data on production volume

Refrigerators, computers, mobile phones are produced in Kazakhstan. But, unfortunately, the data on production volumes have not been found in the open access.

Data on production volumes for products selected for the study in the Republic of Uzbekistan are taken from the report of the largest producer of household electrical equipment - the national holding company UZELTEHSANOAT.

In Kyrgyzstan, Mailuu-Suu Lamp Factory produces various types of electric lamps, including energy-saving luminescent lamps. But the report presents the total number of lamps: "At present, production capacity of the company is 170-180 million pieces of light bulbs. All produced lamps are sold in the domestic market from 10 to 15% of the total output, respectively from this output, exports amount to 85-90% of total shipment."[83] It was impossible to isolate the output of mercury lamps.

In Kyrgyzstan, Tajikistan, Turkmenistan, the refrigerators, computers, phones are not manufactured.

Calculations by countries using the "Market sales" method are presented in Annexes 6-10. Amount of electronic wastes calculated using the "Market sales" method is shown in Table 21.

Table 21

Amount of electronic waste in CA countries calculated based on "Market sales" method (tons)

FEACN	841810 refrigerators	847141 computers	851712 mobile phones	853932 mercury lamps	Total
country					
Kazakhstan	19780	233	1180	238	21431
Kyrgyzstan	1114	9	438	4	1565
Tajikistan	584	2	6	1	593
Turkmenistan	338	32	7	62	439
Uzbekistan	6486	23	75	859	7443
Total					31 471

The table shows calculation results for waste generation volumes for 2016 for selected groups of goods. If the average lifespan of refrigerators is estimated at ten years, then to estimate the volume of waste generation in 2016, it is necessary to estimate the sales volumes of this type of

[82] http://www.trademap.org

[83] http://msel.kg/o-predprijatii/zavod-segodnja/

equipment ten years ago, that is, in 2006. Accordingly, for other categories of goods: for computers in 2012 (average life is 5 years), for phones - 2014 (3 years), for mercury lamps - 2015 (1.5 years).

Thus, according to the calculations, the volume of waste generation by category of goods in five Central Asian countries in 2016 will be 31 471 tons.

2) "Acquisition and use" method

The following data have been used to make calculations based on this method:

The number of households in the country

Official data of the population censuses and the number of households for this period have been used for calculations.

According to the results of the National Population Census of the Republic of Kazakhstan in 2009, the number of households made up 4 391 759, where 16 004,8 thousand people lived.

According to the 2009 Population and Housing Census, there were 1 million 145,7 thousand private households in Kyrgyzstan with a population of 5 million 334,5 thousand people.

According to the 2010 Population and Housing Census of the Republic of Tajikistan, the number of household members in total for the Republic of Tajikistan made up 7 523 010 people, the number of households was 1 197 187.

In Turkmenistan, at the time of the census in 2012, there were 4 751 120 people living in 896,437 households.

The population of Uzbekistan exceeds 31,5 million people. Uzbek families, as a rule, have many children, especially in rural area: on average there are 5-6 members in Uzbek family. Thus, the number of households is approximately 5 250 000.

Saturation rate

The data related to the level of households' provision with various types of electrical appliances have been taken from the study of the United Nations Environment Program and the Central Asian Regional Environmental Center for 2015 "Assessment of energy consumption of household electrical appliances and the policy on energy efficiency of household appliances in Central Asian countries".

It should be noted that the available (estimated) data on provision of household appliances are average across countries and do not reflect the differences between urban and rural households.

With saturation rate of various types of electrical appliances one can see the number of units of electrical appliance per 1 household – this indicator reflects importance or popularity of various types of household appliances for families, and allows to approximately estimate the demand capacity for various types of household appliances depending on their size and purpose.

In Kazakhstan, one can note a high level of provision of households with various types of electrical appliances: refrigerators – 1,03; computers – 0,44; mobile phones – 1,55. This coefficient for Kyrgyzstan is 0,79 for refrigerators; 0,07 for computers; 0,3 for mobile phones. In Tajikistan, provision with refrigerators, computers, mobile phones is 0,23; 1,06; 2,6, respectively. For Turkmenistan: refrigerators – 0,99, computers – 0,41, mobile phones – 0,98. One household in Uzbekistan has 0,99 refrigerators; 0,07 computers; 2,34 mobile phones. Calculations by countries based on the "Acquisition and use" method are given in Annexes 11-15.

Since there is no available data of saturation rate for mercury lamps, calculations for category 853932 - mercury lamps - were not made using this method.

The amount of electronic waste calculated using the "Acquisition and use" method is shown in table 22.

Table 22

The amount of e-waste in CA countries calculated based on "Acquisition and use" method

	FEACN 841810 refrigerators	FEACN 847141 computers	FEACN 851712 mobile phones	Total
Kazakhstan	15832,3	3826,1	226,9	19 885,3
Kyrgyzstan	3167,9	158,8	11,5	3580,1

Tajikistan	963,7	2512,6	103,7	3580
Turkmenistan	3106,1	127,7	69,9	3303,8
Uzbekistan	18 191,3	748,4	409,5	19 349,2
Total	**41 261,3**	**7 373,7**	**821,5**	**49 456,6**

Calculation results showed that currently in five Central Asian countries there are 49 456,6 tons of electrical and electronic equipment for the selected category of goods. After 8-10 years, 41 261,3 tons of waste will be generated in the form of used fridges; in 3-5 years – 7 373,7 tons of used computers, after 2-3 years – 821,5 tons of used mobile phones.

9.3 Mass flow trends

To assess mass flow trends for selected groups of goods, the foreign trade balance values for selected types of goods over the past 10 years were obtained. The value of the foreign trade balance for a certain type of product represents the difference between the volume of imports and exports of this type of goods in the country.

Kyrgyzstan, Tajikistan and Turkmenistan are importers of electronic equipment selected for the study, products of this kind are not produced and are not exported in these countries.

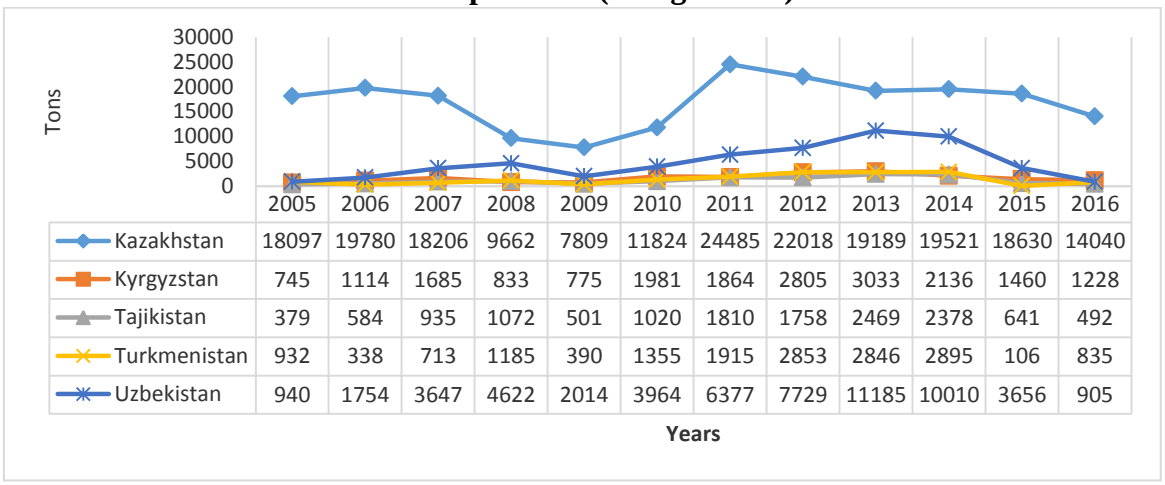
In Kazakhstan and Uzbekistan, there is a production of selected groups of goods. But there is no statistical data by the years of production.

The data on the selected product groups given in the TRADE MAP website in accordance with the categories of the EU Directives and their names (HS Classification and FEACN codes) show that import of machinery and equipment in CA countries until 2013 in general tends to grow. Because of economic crisis in recent years, equipment imports declined.

The graphs of the “Foreign trade balance of products in CA countries” revealed that from the groups of products selected for the study, import was reduced constantly of combined refrigerator-freezers with separate external doors (code 841810), computers containing in one package at least central processing unit and data input and output device, combined or not, i.e. computers (code 847141).

Diagram 21

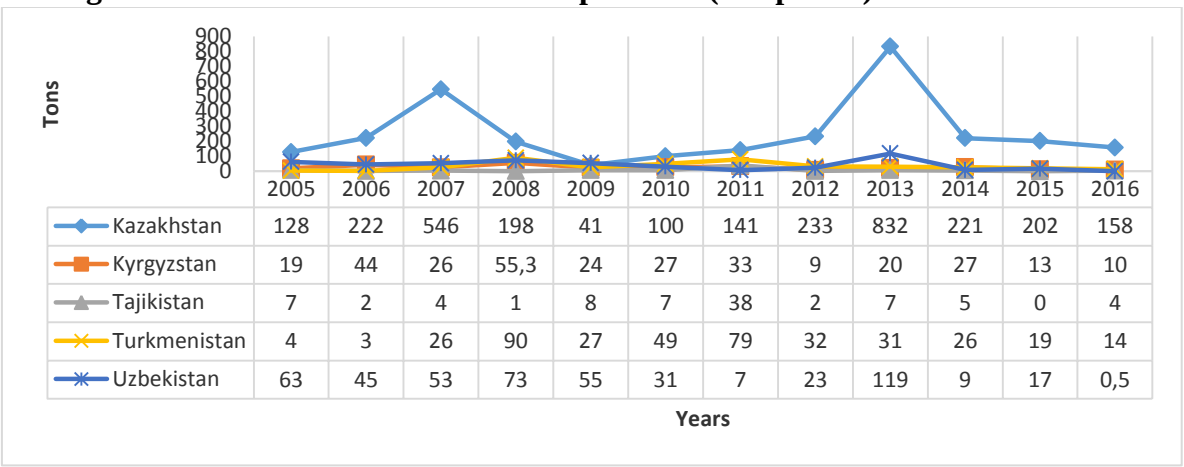
Foreign trade balance of FEACN 841810 products (refrigerators) in CA countries



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Kazakhstan	18097	19780	18206	9662	7809	11824	24485	22018	19189	19521	18630	14040
Kyrgyzstan	745	1114	1685	833	775	1981	1864	2805	3033	2136	1460	1228
Tajikistan	379	584	935	1072	501	1020	1810	1758	2469	2378	641	492
Turkmenistan	932	338	713	1185	390	1355	1915	2853	2846	2895	106	835
Uzbekistan	940	1754	3647	4622	2014	3964	6377	7729	11185	10010	3656	905

Diagram 22

Foreign trade balance of FEACN 847141 products (computers) in CA countries



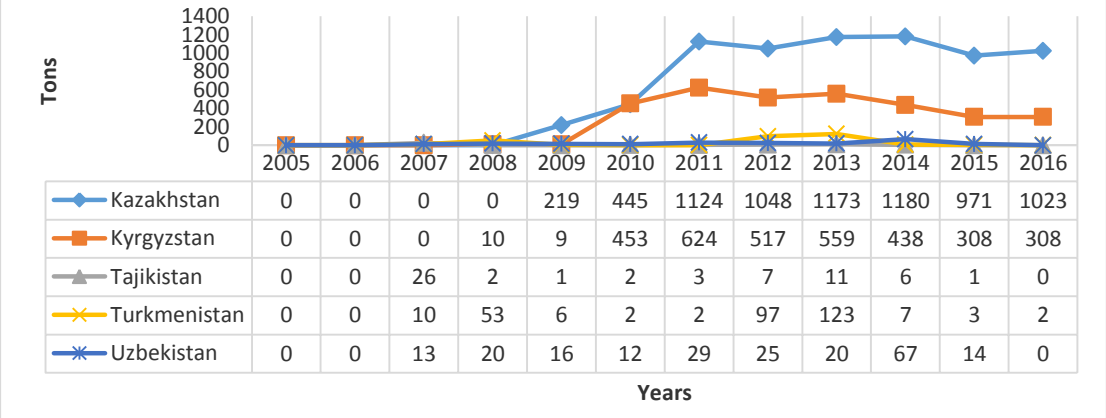
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Kazakhstan	128	222	546	198	41	100	141	233	832	221	202	158
Kyrgyzstan	19	44	26	55,3	24	27	33	9	20	27	13	10
Tajikistan	7	2	4	1	8	7	38	2	7	5	0	4
Turkmenistan	4	3	26	90	27	49	79	32	31	26	19	14
Uzbekistan	63	45	53	73	55	31	7	23	119	9	17	0,5

In 2016, 2 times less refrigerators-freezers were imported and sold accordingly compared to 2013, and almost 5.5 times less of computers. At that, the biggest gap occurred in Kazakhstan.

The same trend is observed with telephone sets for cellular communication networks or other wireless communication networks (code 851712). Thus, for example, 1,023 tons of this product were offered in the domestic market of Kazakhstan in 2016, and 1 173 tons in 2013. But if to compare with the data of 2015, in 2016 the demand for this type of products (code 851712), began to increase although insignificantly.

Diagram 23

Foreign trade balance of FEACN 851712 products in CA countries

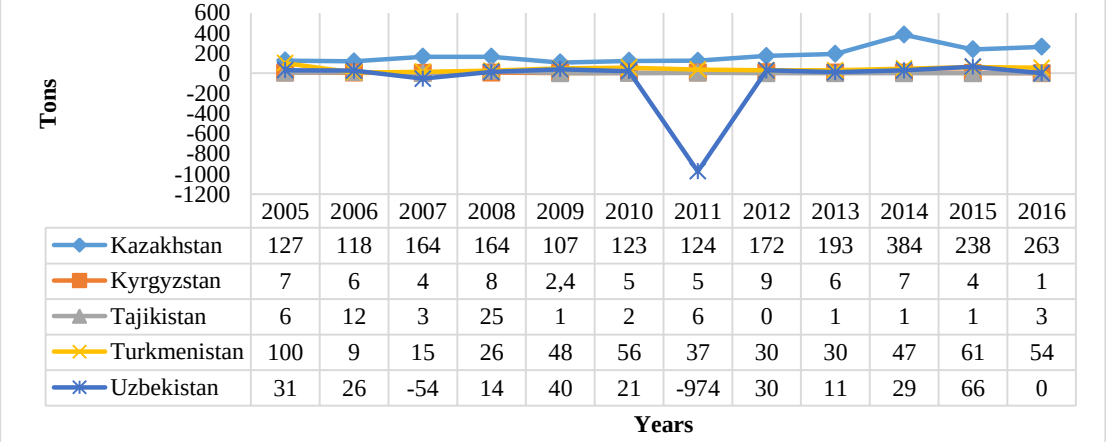


	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Kazakhstan	0	0	0	0	219	445	1124	1048	1173	1180	971	1023
Kyrgyzstan	0	0	0	10	9	453	624	517	559	438	308	308
Tajikistan	0	0	26	2	1	2	3	7	11	6	1	0
Turkmenistan	0	0	10	53	6	2	2	97	123	7	3	2
Uzbekistan	0	0	13	20	16	12	29	25	20	67	14	0

By 2016, to an insignificant extent (1.3 times in relation to 2013) the balance has increased in importation of mercury, sodium, metal halide lamps (code 853932) in countries such as Kazakhstan and Turkmenistan.

Diagram 24

Foreign trade balance of FEACN 853932 products in CA countries



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Kazakhstan	127	118	164	164	107	123	124	172	193	384	238	263
Kyrgyzstan	7	6	4	8	2,4	5	5	9	6	7	4	1
Tajikistan	6	12	3	25	1	2	6	0	1	1	1	3
Turkmenistan	100	9	15	26	48	56	37	30	30	47	61	54
Uzbekistan	31	26	-54	14	40	21	-974	30	11	29	66	0

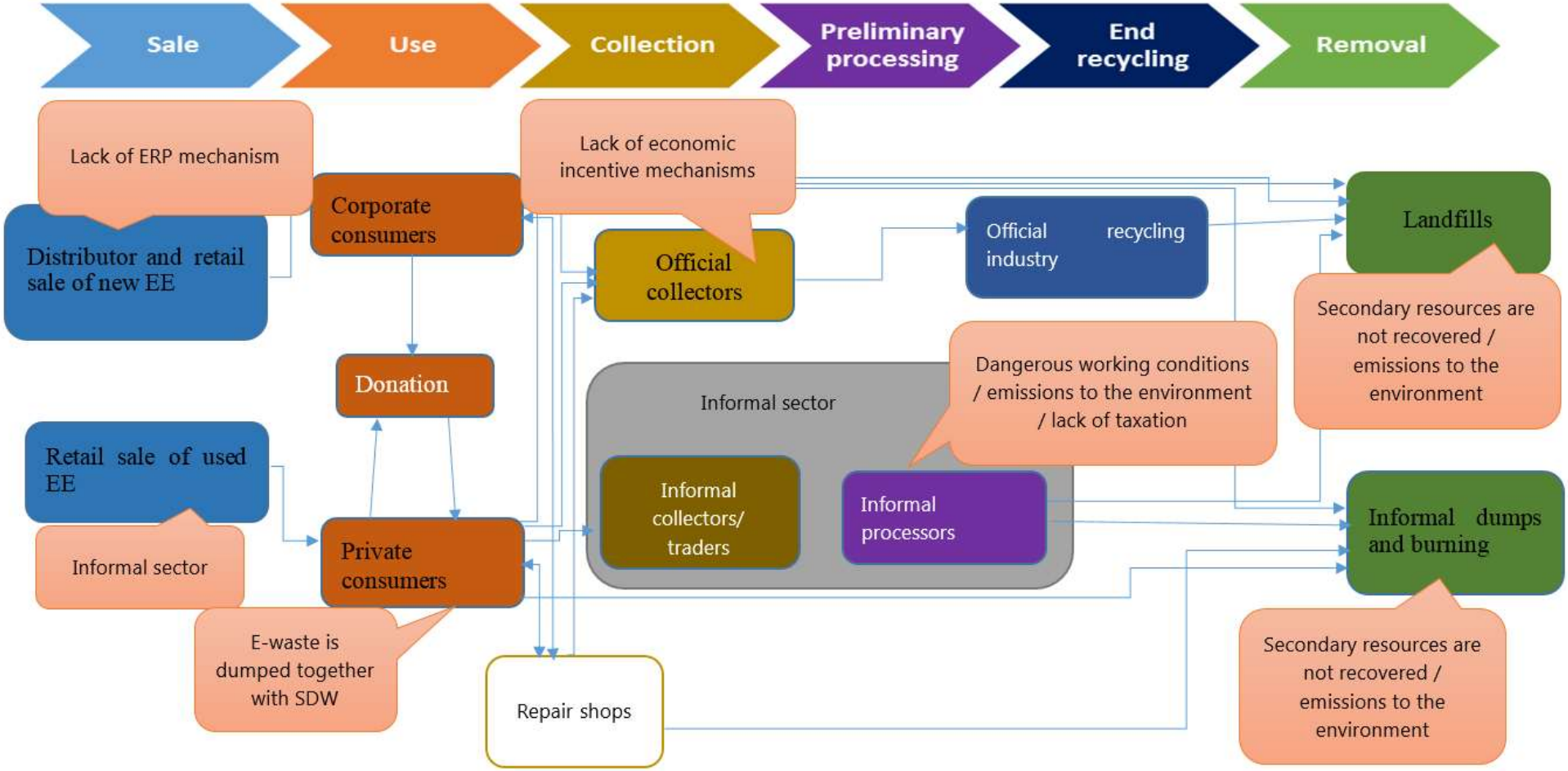
According to “TRADE MAP” data, five major importers of “machines, mechanical appliances, nuclear reactors, boilers and parts thereof” - Product: 84 to the countries of Central Asia include China, Italy, Russia, Germany and South Korea.

China has a leading position in terms of importation of other types of electronic equipment: Product 85 – “electrical machines and equipment and parts thereof; sound recording devices and reproducers, television devices for image and sound reproduction and loudspeakers, as well as parts and accessories of such products”.

10 Impacts

Figure 2

Scheme of mass flow system with undesirable operations / "hot spots' on the example of Kyrgyzstan



10.1 Assessment of e-waste impacts on the environment and human health

The rapid growth in the amount of electronic waste in the waste flow for a sufficiently long time is of concern to the international community, since there is enough information regarding negative environmental and health consequences of the impact of electronic waste dumped on a conventional landfill. This is related to the fact that electronic waste does not decompose over time and contains harmful substances such as arsenic, led, mercury, cadmium and etc., which are actively released into the atmosphere when burning in ordinary municipal landfills.

However, apart from toxic substances that pose danger to the environment and the population, electronic waste contains valuable materials that can be reused in economic activities. Extraction of valuable resources from electronic waste in developing countries is still at the artisanal level and is one of shadow business sectors. This, in turn, is no less dangerous for the environment and public health, since in places of informal processing of electronic waste, no sanitary and hygienic norms and safety rules are observed.

Below, several examples are given showing what is the danger of electronic waste, and how it might affect the environment and human health, regardless of whether it gets directly to a landfill or is processed in primitive way.

Thus, for example, plastic electronic equipment housings can be used as raw materials. However, for environmentally safe processing, different types of plastic require different temperature regimes, in addition, plastic from office equipment contains small iron particles, which requires careful sorting. That is why informal waste handlers put plastic into the dump. With open burning of plastic, dioxins, furans, styrenes, bisphenol A and other components are emitted to the atmosphere. The content of cadmium, led, zinc and tin in flue gases varies depending on the content of plastic waste in garbage.

Printed circuit boards are also very dangerous, due to high concentration of toxic substances in their composition. In addition to precious metals, printed circuit boards also contain organic resins, ceramic elements and fiberglass.

As has been noted, official sector of electronic waste recycling has not been formed yet in Central Asia. Official recycling is only at the beginning of its development.

Enterprises officially engaged in recycling activities are economically disadvantaged in comparison with the enterprises belonging to shadow economy, because this is related to red tape and the need for financial investments by entrepreneurs. In addition, there are no incentive mechanisms regulated at the legislative level. Therefore, state support is required for the entrepreneurs engaged in legal activities.

The sector of illegal electronic waste processing has low operating costs in comparison with official processors, therefore informal processing of e-waste is quite common in the countries of Central Asia, since it is quite profitable business. Illegal activities related to collection and processing of electrical and electronic waste involve labor-intensive and often dangerous manual dismantling of equipment using simple tools for rapid separation of materials. Hazardous practice of handling electronic waste by illegal processors includes open burning, direct melting of plastics, removal of toner, disposal of led-containing electro-ray tubes, acid treatment of printed circuit boards, and disposal of other waste containing such hazardous components as polychlorinated betoniles and chlorofluorocarbons directly affecting soil or getting to water sources. This practice poses a direct threat to the health of workers and the environment. Very often, poor and the most vulnerable segments of the population, including women and children, are working in such industries.

For each category of selected groups of goods, amount of waste generated has been calculated by components. For calculation purpose, the values of waste generation for selected

groups of goods obtained based on “Market sales” method for 2016 have been used (Section 9.2.). Calculation results are shown in tables 23-26.

Table 23

Amount of waste generated of the category “household refrigerators that lost their consumer properties” by components and by countries, tons (2016)

Waste composition		Kazakhstan	Kyrgyzstan	Tajikistan	Turkmenistan	Uzbekistan
	Total waste, tons	**19780**	**1114**	**584**	**338**	**6486**
	% of component					
Copolymer ABC 750 SW	6%	11.9	0.7	0.4	0.2	3.9
Cyclopentane blowing agent	13%	25.7	1.4	0.8	0.4	8.4
Refrigerating medium 600a	0.06%	0.1	0.0	0.0	0.0	0.0
Carbon steel sheet rolled	32%	63,3	3.6	1.9	1.1	20.8
Aluminum and aluminum-based alloyse	1%	2.0	0.1	0.1	0.0	0.6
Copper and copper-based alloys (brass, bronze)	3%	5.9	0.3	0.2	0.1	1.9
Chemical phosphate coating / polyester powder composition	2%	4.0	0.2	0.1	0.1	1.3
Polystyrene shockproof -825	10 %	1978.0	111.4	58.4	33.8	648.6
Safety glass tempered	4%	791.2	44.6	23.4	13.5	259.4
Polystyrene 525	5 %	989.0	55.7	29.2	16.9	324.3
Polystyrene shockproof	22%	4351.6	245.1	128.5	74.4	1426.9

Table 24

Amount of waste generated of the category “personal computers” by components and by countries, tons (2016)

Waste composition		Kazakhstan	Kyrgyzstan	Tajikistan	Turkmenistan	Uzbekistan
	Total waste, tons	**233**	**9**	**2**	**32**	**23**
Keyboard, mouse manipulator with connecting wires that lost its consumer properties						
Thermoplastic housing	77%	179.4	6.9	1.5	24.6	17.7
Textolite (PCB assembly)	4.1%	9.6	0.4	0.1	1.3	0.9
Polypropylene	1.21%	2.8	0.1	0.0	0.4	0.3
Rubber	6.6%	15.4	0.6	0.1	2.1	1.5
Insulation of wires (polyvinyl chloride)	2.22%	5.2	0.2	0.0	0.7	0.5
Iron	4.83%	11.3	0.4	0.1	1.5	1.1
Copper	3.85%	9.0	0.3	0.1	1.2	0.9
paper (with adhesive layer)	0.1%	0.2	0.0	0.0	0.0	0.0
System unit that lost its consumer properties						
Rubber resin	1.06%	2.5	0.1	0.0	0.3	0.2
Ferrous metal	48.89%	113.9	4.4	1.0	15.6	11.2
Non-ferrous metal	11.19%	26.1	1.0	0.2	3.6	2.6
Polyethylene	0.08%	0.2	0.0	0.0	0.0	0.0
Foam rubber	0.018%	0.0	0.0	0.0	0.0	0.0
Plastic	19.74%	46.0	1.8	0.4	6.3	4.5
Glass	0.006%	0.0	0.0	0.0	0.0	0.0
Textolite	19%	44.3	1.7	0.4	6.1	4.4

Assembly of LCD monitor that lost its consumer properties						
Ferrous metal	6.2%	14.4	0.6	0.1	2.0	1.4
Non-ferrous metal	4.3%	10.0	0.4	0.1	1.4	1.0
Polymeric materials	32.3%	75.3	2.9	0.6	10.3	7.4
Glass	57.2%	133.3	5.1	1.1	18.3	13.2

Table 25

Amount of waste generated of the category "mobile phones" by components and by countries, tons (2016)

Waste composition		Kazakhstan	Kyrgyzstan	Tajikistan	Turkmenistan	Uzbekistan
		1180	**438**	**6**	**7**	**75**
ABC plastic (case)	56	660.8	245.28	3.36	3.92	42
Metals (iron, tin)	18	212.4	78.84	1.08	1.26	13.5
Copper	16	188.8	70.08	0.96	1.12	12
Glass (display)	3	35.4	13.14	0.18	0.21	2.25
Other	7	82.6	30.66	0.42	0.49	5.25

Table 26

Amount of waste generated of the category "mercury lamps" by components and by countries, tons (2016)

Waste composition		Kazakhstan	Kyrgyzstan	Tajikistan	Turkmenistan	Uzbekistan
	Total waste, tons	**238.00**	**4.00**	**1.00**	**62.00**	**859.00**
Aluminum	5%	11.90	0.20	0.05	3.10	42.95
Luminophor	3%	7.14	0.12	0.03	1.86	25.77
Other	2.3%	5.47	0.09	0.02	1.43	19.76
Mercury	0.15%	0.36	0.01	0.00	0.09	1.29
Led	2.55%	6.07	0.10	0.03	1.58	21.90
Glass	87%	207.06	3.48	0.87	53.94	747.33

To date, ferrous and non-ferrous metals, glass and plastic are the most demanded components in the selected groups of goods[84]. These components having being extracted may be used as secondary material resources. That is why their amount has been calculated in the amount of waste calculated based on "Market sale" method for 2016. (Section 9.2.). The values of useful component amounts in the generated waste are given in table 27.

Table 27

Amount of components useful for recycling by countries for 2016 (tons).

Waste composition		Kazakhstan	Kyrgyzstan	Tajikistan	Turkmenistan
Ferrous metal	415.31	87.83	4.18	21.53	48.08
Non-ferrous metal	254	72	2	11	62
Glass	1167	66	26	86	1,022
Polymeric materials	8,295	670	222	171	2,476

Calculation results show that upon proper processing, the amount of extracted useful components are rather significant and may of use for the enterprises that use these components in their production. That is why shadow business is so interested in electrical and electronic waste.

[84] The data on component composition of waste of commodity groups FEACN (841810, 847141, 851712, 853932) are taken from the following websites: http://ecobatman.ru/othodi_sostav.php и http://ecoportal.su/wastet.php.

Conclusion

Initial assessment of electronic waste in five Central Asian countries, the framework conditions and the capacity of these countries to develop management system for this type of waste have been identified. As part of the study, a review of national legislation was carried out to identify specific regulatory legal acts regulating electronic waste management in the countries. Preliminary qualitative and quantitative assessment of groups of goods of selected categories has been carried out, namely, amounts of waste generation at present and its potential possible amount, which will be generated after several years depending on their service life, have been calculated. Key stakeholders involved in electronic waste management have been identified for two countries: Kyrgyzstan and Tajikistan. Potential impacts of the processes related to electronic waste management on the environment and public health have been assessed.

Summing up the results obtained we can come up with the following conclusions:

- The countries of Central Asia differ in terms of their area, the population, natural resources reserves, the level of economic and human development and political course. To date, there is rapid economic growth in countries such as Kazakhstan and Uzbekistan, compared with other neighboring states. The positive aspects of economic development in Turkmenistan include presence of large hydrocarbon reserves, the available transit potential, political stability and continuity of the economic course. Kyrgyzstan has cheap labor force, favorable conditions for development of agriculture, light industry and tourism; this country along with Kazakhstan is a member state of the EAEU and has access to a unified market of the association. Tajikistan has cheap labor force, with some minerals and favorable climate for agriculture development. Economic growth in the region largely depends on commodity orientation of the economy and the world commodity prices.

- In Central Asian countries, as well as all over the world, the amount of electric and electronic waste is growing rapidly. For example, over the past decade, the number of computer and mobile phone users has increased dramatically. Judging by the scale and growth rates of the electronic equipment market and a sharp increase in electronic waste, in the countries of Central Asia there is a great need, and most importantly - the ability to formulate and implement approaches to processing this type of waste, based, on the one hand, on reducing the burden on the environment and the amount of waste to be disposed, and on the other hand, ensuring recovery and involvement of useful components into the secondary circulation.

- Although the sphere of legal regulation in the field of waste management in all countries is sufficiently developed, not all the rules are applied in practice and require improvement and regulation, since there is a large number of reference rules in the legislation. Unlike other countries, in Kazakhstan and Uzbekistan today there is a special legislation aimed at regulating the processes of electronic waste management, which creates the prerequisites for recycling industry development in these countries, but the amount of collection and processing of this type of waste is still small. The situation is complicated by the fact that a significant amount of waste is processed in the semi-legal sector, which is common in all five countries of the Central Asian region. Many companies only recover the most commercially attractive components, and the rest components are dumped to municipal landfills.
- Low level of electronic waste collection is one of the main obstacles for establishment of e-waste recycling sector. Basically, all electronic waste is dumped to landfill. The

legislation of the countries either does not stipulate the obligation of consumers to transfer used equipment to licensed collectors and processors, or this norm is not sufficiently developed.

- Stakeholder assessment in Kyrgyzstan and Tajikistan revealed that so far in these countries there were no conditions for separate collection of electronic waste and its processing, despite sufficient awareness of stakeholders about the problems arising from undue handling of electronic waste. A significant part of consumers of electronic equipment is limited to either storing their electronic equipment that has been used up, or throwing it away together with other household waste. Repairmen do the same thing - equipment that is not subject to repair gets to the landfill. Official waste collectors place electronic waste along with other household waste in landfills. The official processing sector is poorly developed, for example, in Kyrgyzstan there is only one enterprise for electronic waste processing. Illegal processing of electronic waste is quite a common phenomenon, since it is quite profitable business, which is primarily due to low operating costs compared to that of official processors. Illegal activities related to collection and processing of electrical and electronic waste include labor-intensive and often dangerous manual dismantling of equipment using simple tools for rapid separation of materials and is mainly limited to recovering the most valuable and accessible components.
- Civil society and public organizations are important actors in the process, they often come up with initiatives that can influence policy at all levels, and their good will is a key for the success of local and national waste management strategies.

- Mass flow assessment was carried out on the example of four groups of electrical and electronic equipment selected for the study: refrigerators with separate doors, computers, mobile phones and mercury lamps. Here it should be noted that Kyrgyzstan, Tajikistan and Turkmenistan are importers of electronic equipment selected for the study. Kazakhstan and Uzbekistan produce the selected groups of goods. But there is no statistical data by the years of production.
- During mass flow assessment it was found that the amount of waste generation for the selected categories of goods (refrigerators, computers, mobile phones, mercury lamps) in five Central Asian countries in 2016 made up 31,471 tons. According to the calculations, the greatest amount of waste was generated in Kazakhstan amounting to 21431 tons, the smallest amount - in Turkmenistan - 439 tons, which is directly related to the level of consumer demand for these types of goods, which depends on purchasing power of the population for the period from 2006 to 2011. Currently, there are 49,456.6 tons of electrical and electronic equipment in five Central Asian countries for the selected category of goods. After 8-10 years, 41,261.3 tons of waste will be generated in the form of used fridges; in 3-5 years – 7,373.7 tons of used computers, after 2-3 years - 821.5 tons of obsolete mobile phones.

- Assessing the impact of the electronic waste processing sector on the environment and public health, it is found that the main danger causes the activity of illegal processors, which includes open burning, direct melting of plastics, removal of toner, disposal of led-containing electro-ray tubes, acid treatment of printed circuit boards, and burial of other wastes containing such dangerous components as polychlorinated befiniles and chlorofluorocarbons, directly affecting the soil or getting into water sources. This practice poses a direct threat to the health of workers and the environment. Very often, workers in such industries are the poor and the most vulnerable segments of the population, such as women and children.

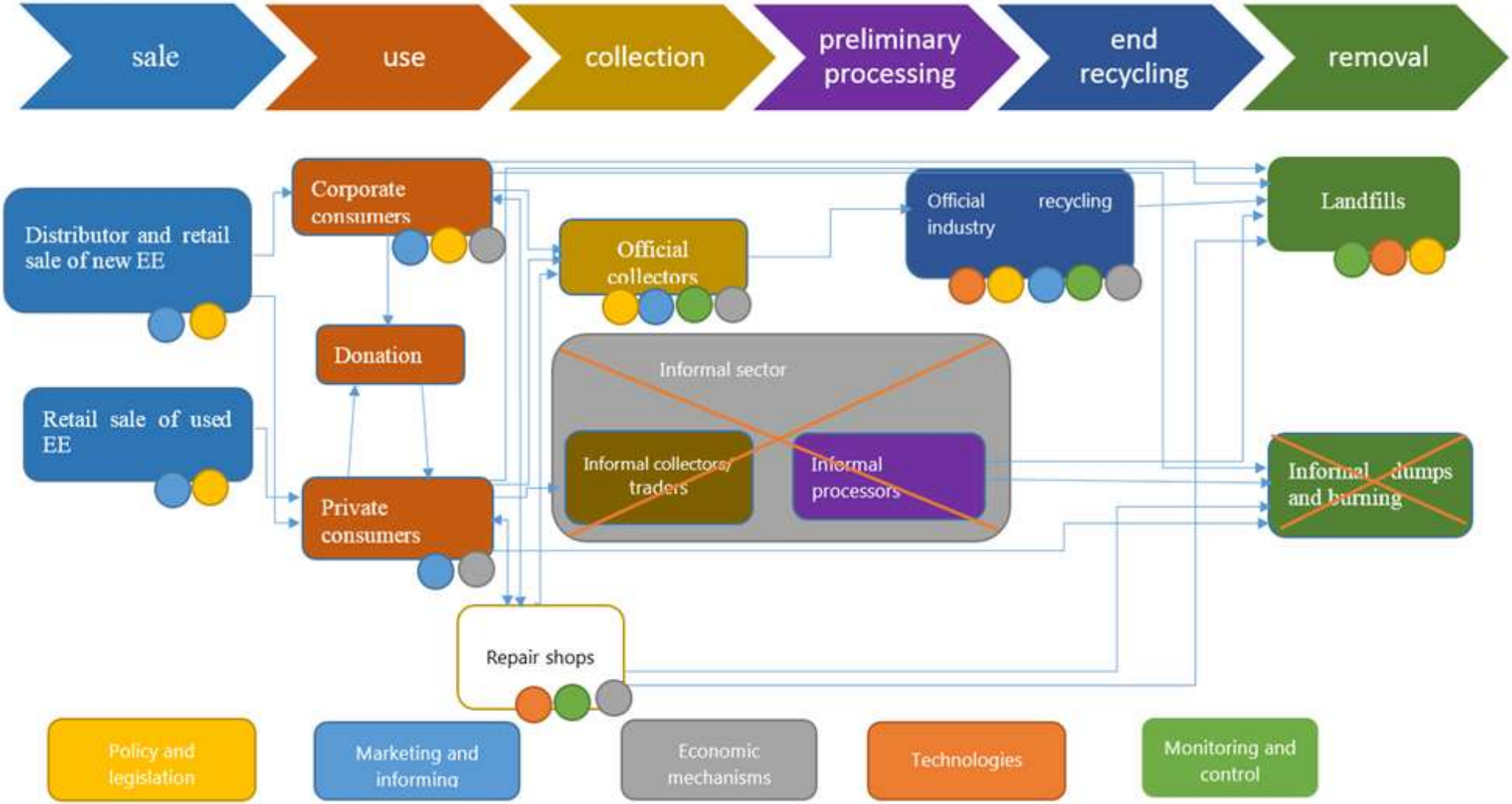
Thus, summing up the results of the study, it should be noted that electronic and electrical equipment waste management system in the region is poorly developed and requires more attention from the part of the state. Efficiently operating system for electrical and electronic equipment waste

management as shown by world practice, is based on commitment of the government, regulation of requirements at the legislative level, focusing the society on separate waste collection to preserve the environment and protect human health.

To ensure long term sustainability of the system, apart from the different levels and actors of the process, special attention should be paid to infrastructure issues: collection, sorting, transportation, processing, reuse and disposal systems, and links between different sectors and social issues. The positive emerging trends in Kazakhstan and Uzbekistan related to adoption of special legislative acts in the sphere of electronic waste management, require active law enforcement practice. To develop the official recycling sector in the countries, incentive economic mechanisms and simplification of the procedures for legalization of waste-processing enterprises are required.

Figure 3

Scheme of mass flows with undesirable operations / "hot spots" and recommended interventions



Annexes

Annex 1

Volume of imported/exported products (ТЭН ВД[85] 847141,841810, 851712, 853932) to / from Kazakhstan

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Computers containing in one case at least central data processing unit and input and output device combined or not ТЭН ВД 847141												
Import in thousands of US $	15277	23786	40390	12821	6345	7563	15141	21288	58531	32510	15951	15118
Import in tons	129	224	550	198	42	101	174	728	1649	892	206	160
Export in thousands of US $	141	108	132	366	1210	31	1306	8293	23464	30468	596	527
Export in tons	1	2	4	0	1	1	33	495	817	671	4	2
Combined refrigerator-freezers, with separate external doors ТЭН ВД 841810												
Import in thousands of US $	56104	68014	70848	45622	33185	51612	117621	111966	98493	97597	110566	49834
Import in tons	18444	19939	18373	9814	7815	11827	24486	22019	19192	19528	18631	14173
Export in thousands of US $	576	248	282	295	28	12	4	3	38	46	3	688
Export in tons	347	159	167	152	6	3	1	1	3	7	1	133
Telephone sets for cellular communication networks or other wireless communication network ТЭН ВД 851712												
Import in thousands of US $	0	0	0	0	33933	89692	303790	339844	505605	592856	422179	389428
Import in tons	0	0	0	0	225	449	1187	1161	1256	1410	1058	1084
Export in thousands of US $	0	0	0	0	1580	791	8094	30298	25120	232282	38239	15568
Export in tons	0	0	0	0	6	4	63	113	83	230	87	61
Mercury or sodium lamps; metal halide lamps ТЭН ВД 853932												
Import in thousands of US $	2124	2168	3478	3437	2268	2497	2547	3695	4129	3314	2064	1676
Import in tons	127	118	167	166	110	123	124	172	193	384	238	263
Export in thousands of US $	0	1	72	43	20	0	4	5	3	2	1	2
Export in tons	0	0	3	2	3	0	0	0	0	0	0	0

[85] FEACN of the EAEU

Annex 2

Volume of imported/exported products (ТЭН ВД[86] 847141,841810, 851712, 853932) to/from Kyrgyzstan

	2005	2006	2007	2008	2009	2010	2011	2012		2013	2014	2015	2016
Computers containing in one case at least central data processing unit and input and output device combined or not ТЭН ВД 847141													
Import in thousands of US $	1827	3,327	3592	4376	1709	867	1419	823		1486	1210	1405	1337
Import in tons	19	45	27	5688 units	2411 units	27	34	10		20	27	13	10
Export in thousands of US $	1	51	587	109	0	17	277	6		42	3	3	6
Export in tons	0	1	1	1	0	0	1	1		0	0	0	0
Combined refrigerator-freezers, with separate external doors ТЭН ВД 841810													
Import in thousands of US $	2012	3542	6124	3711	3634	4913	8153	11193		11678	8893	4897	3857
Import in tons	745	1114	1685	833	775	1981	1864	2805		3033	2136	1460	1228
Export in thousands of US $	4	0	0	0	1	0	0	0		0	0	0	0
Export in tons	0	0	0	0	0	0	0	0		0	0	0	0
Telephone sets for cellular communication networks or other wireless communication network ТЭН ВД 851712													
Import in thousands of US $	0	0	0	3564	4920	32277	40209	34972		35748	31647	25670	29120
Import in tons	0	0	0	10	14	469	628	517		559	438	308	308
Export in thousands of US $	0	0	0	5	1610	4332	376	8		41	0	31	10
Export in tons	0	0	0	0	5	16	4	0		0	0	0	0
Mercury or sodium lamps; metal halide lamps ТЭН ВД 853932													
Import in thousands of US $	90	64	67	112	43	63	146	255		103	109	122	17
Import in tons	7	6	4	30772 units	9459 units	5	7	12		6	7	4	1
Export in thousands of	0	0	0	0	0	0	36	73		0	0	0	0

[86] FEACN of the EAEU

	2005	2006	2007	2008	2009	2010	2011	2012		2013	2014	2015	2016
US $													
Export in tons	0	0	0	0	0	0	2	3		0	0	0	0

Annex 3

Volume of imported/exported products (ТЭН ВД[87] 847141,841810, 851712, 853932) to/from Tajikistan

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Computers containing in one case at least central data processing unit and input and output device combined or not ТЭН ВД 847141												
Import in thousands of US $	252	207	462	40	1016	731	4504	214	373	83	117	298
Import in tons	7	2	12	1	8	7	38	2 tons+ 6 units	7	5	0	4
Export in thousands of US $	0	13	98	0	0	4	0	0	6	3	14	0
Export in tons	0	0	8	0	0	0	0	0	0	0	0	0
Combined refrigerator-freezers, with separate external doors ТЭН ВД 841810												
Import in thousands of US $	1437	2105	3461	4945	2285	4062	7257	6576	9125	10529	2475	1546
Import in tons	379	584	935	1137	559	1061	1887	1758	2470	2378	641	492
Export in thousands of US $	0	0	0	277	296	261	378	0	9	0	0	0
Export in tons	0	0	0	65	58	41	77	0	1	0	0	0
Telephone sets for cellular communication networks or other wireless communication network ТЭН ВД 851712												
Import in thousands of US $	0	0	4206	996	649	867	1097	1904	1968	3913	407	164
Import in tons	0	0	11 tons+ 151128 units	3	1	2	3	6 tons+ 29935units	11	6 tons+ 2 units	1 tons+ 1units	0
Export in thousands of US $	0	0	0	68	0	0	0	0	1	0	13	0

[87] FEACN of the EAEU

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Export in tons	0	0	0	1	0	0	0	2	0	0	0	0
Mercury or sodium lamps; metal halide lamps ТЭН ВД 853932												
Import in thousands of US $	123	179	100	347	31	103	59	17	55	72	57	200
Import in tons	6	12	3	25	1	2	6	543 units	1	1	1	3
Export in thousands of US $	данных нет											
Export in tons												

Annex 4

Volume of imported/exported products (ТЭН ВД[88] 847141,841810, 851712, 853932) to/from Turkmenistan

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Computers containing in one case at least central data processing unit and input and output device combined or not ТЭН ВД 847141												
Import in thousands of US $	151	275	1046	7724	2882	5177	12038	3560	2682	2386	1381	1248
Import in tons	4	3	26	90	27	49	79	32 tons+ 25units	31	26	17 tons+ 222 units	14 tons+ 51 units
Export in thousands of US $	0	0	1	0	0	0	43	2	1	0	0	35
Export in tons	0	0	0	0	0	0	0	0	0	0	0	0
Combined refrigerator-freezers, with separate external doors ТЭН ВД 841810												
Import in thousands of US $	3631	1314	2720	4868	1936	5657	8296	11073	10924	11905	4256	2981
Import in tons	932	338	713	1185	390	1355	1915	2853	2846	2895	987 tons+ 2078 units	835
Export in thousands of US $	0	0	0	0	0	0	0	0	0	0	0	0

[88] FEACN of the EAEU

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Export in tons	0	0	0	0	0	0	0	0	0	0	0	0
Telephone sets for cellular communication networks or other wireless communication network ТЭН ВД 851712												
Import in thousands of US $	12211	2800	23799	65366	36013	62617	104904	130904	197302	102253	77106	14600
Import in tons	0	0	10 tons+ 4279 units	53 tons+450 units	6	2	2	97 tons+ 2203 units	123 tons+ 500 units	7 tons+ 450 units	3 tons+ 663 units	2 tons+ 4478 units
Export in thousands of US $	0	0	4	19	0	0	0	1	0	51	0	0
Export in tons	0	0	0	0	0	0	0	0	0	0	0	0
Mercury or sodium lamps; metal halide lamps ТЭН ВД 853932												
Import in thousands of US $	933	139	343	639	942	934	942	628	988	892	1033	714
Import in tons	100	9	15 tons+ 1672 units	26	48 tons+ 2599 units	56	37	20 tons+ 39396 units	30	47	57 tons+ 8137units	54
Export in thousands of US $	0	0	1	1	0	4	0	40	7	17	2	1
Export in tons	0	0	0	0	0	0	0	0	0	0	0	0

Annex 5

Volume of imported/exported products (ТЭН ВД[89] 847141,841810, 851712, 853932) to/from Uzbekistan

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Computers containing in one case at least central data processing unit and input and output device combined or not ТЭН ВД 847141												
Import in thousands of US $	2463	4913	6213	5884	4162	1929	817	1473	1139	812	2952	329
Import in tons	63	45	53	74	56	31	7	23 tons+ 9 units	119	9	16 tons+ 134 units	51 units
Export in thousands of US $	3	0	6	2	98	1	62	297	116	3	0	0

[89] FEACN of the EAEU

Export in tons	0	0	0	1	1	0	0	0	0	0	0	0
Combined refrigerator-freezers, with separate external doors ТЭН ВД 841810												
Import in thousands of US $	3280	5734	13029	17495	8316	14901	24596	29617	40152	39314	13949	4318
Import in tons	940	1754	3647	4622	2014	3964	6403	7740	11193	10013	3744 tons+ 2862 units	709 tons+ 9104 units
Export in thousands of US $	0	0	0	0	0	0	104	53	43	16	333	402
Export in tons	0	0	0	0	0	0	26	11	8	3	89	122
Telephone sets for cellular communication networks or other wireless communication network ТЭН ВД 851712												
Import in thousands of US $	0	0	4137	6910	8009	4904	12507	11849	12366	21557	5046	2487
Import in tons			10 tons+ 28927 units	20	16	12	29	7 tons+ 179447 units	20	67	3 tons+ 107517 units	2029 units
Export in thousands of US $	0	0	4	23	11	63	85	112	40	86	2	0
Export in tons	0	0	0	0	0	0	0	0	0	0	0	0
Mercury or sodium lamps; metal halide lamps ТЭН ВД 853932												
Import in thousands of US $	389	370	561	323	505	719	670	465	452	889	376	2
Import in tons	31	26	23 tons+ 84330 units	14	18 tons+ 87364units	21	31	5 tons+ 101827 units	11	29	2 tons+ 256122 units	0
Export in thousands of US $	0	0	1	0	0	2	11	0	0	0	0	0
Export in tons	0	0	98	0	0	0	1005	0	0	0	0	0

Annex 6

Amount of electronic wastes for chosen categories of products in Kazakhstan, calculated by the method of "Market Sales"

ТН ВЭД (FEACN) USED VALUES	841810 – Fridges	847141 – Computers	851712 – Mobile phones	853932 – Mercury lamps
Ls - Average lifetime of a new product (years)	10	5	3	1,5
Year of sale	2006	2012	2014	2015
N1 - National production of electrical and electronic equipment of a certain category in a year in tons	No data			
Average weight per product (kg)	35	9,9	0,1	0,25
N2 - Import of electrical and electronic equipment of a certain category in a year in tons	19939	728	1410	238
N3 - Export of electrical and electronic equipment of a certain category in a year in tons	159	495	230	0
N0 - National sales of electrical and electronic equipment of a certain category in a year in tons	19780	233	1180	238
Amount of electronic wastes in tons	**19780**	**233**	**1180**	**238**

Annex 7

Amount of electronic wastes for chosen categories of products in Kyrgyzstan, calculated by the method of "Market Sales"

ТН ВЭД (FEACN) USED VALUES	841810 – Fridges	847141 – Computers	851712 – Mobile phones	853932 – Mercury lamps
Ls - Average lifetime of a new product (years)	10	5	3	1,5
Year of sale	2006	2012	2014	2015
N1 - National production of electrical and electronic equipment of a certain category in a year in tons	No data			
Average weight per product (kg)	35	9,9	0,1	0,25
N2 - Import of electrical and electronic equipment of a certain category in a year in tons	1114	10	438	4
N3 - Export of electrical and electronic equipment of a certain category in a year in tons	0	1	0	0
N0 - National sales of electrical and electronic equipment of a certain category in a year in tons	1114	9	438	4
Amount of electronic wastes in tons	**1114**	**9**	**438**	**4**

Annex 8

Amount of electronic wastes for chosen categories of products in Tajikistan, calculated by the method of "Market Sales"

ТН ВЭД (FEACN) USED VALUES	841810 – Fridges	847141 – Computers	851712 – Mobile phones	853932 – Mercury lamps
Ls - Average lifetime of a new product (years)	10	5	3	1,5
Year of sale	2006	2012	2014	2015
N1 - National production of electrical and electronic equipment of a certain category in a year in tons	0	0	0	0

Average weight per product (kg)	35	9,9	0,1	0,25
N2 - Import of electrical and electronic equipment of a certain category in a year in tons	584	2,05	6	1
N3 - Export of electrical and electronic equipment of a certain category in a year in tons	0	0	0	0
N0 - National sales of electrical and electronic equipment of a certain category in a year in tons	584	2,05	6	1
Amount of electronic wastes in tons	**584**	**2,05**	**6**	**1**

Annex 9

Amount of electronic wastes for chosen categories of products in Turkmenistan, calculated by the method of "Market Sales"

ТН ВЭД (FEACN) / **USED VALUES**	**841810 – Fridges**	**847141 – Computers**	**851712 – Mobile phones**	**853932 – Mercury lamps**
Ls - Average lifetime of a new product (years)	10	5	3	1,5
Year of sale	2006	2012	2014	2015
N1 - National production of electrical and electronic equipment of a certain category in a year in tons	0	0	0	0
Average weight per product (kg)	35	9,9	0,1	0,25
N2 - Import of electrical and electronic equipment of a certain category in a year in tons	338	32,24	7,04	61,5
N3 - Export of electrical and electronic equipment of a certain category in a year in tons	0	0	0	0
N0 - National sales of electrical and electronic equipment of a certain category in a year in tons	338	32,24	7,04	61,5
Amount of electronic wastes in tons	**338**	**32,24**	**7,04**	**61,5**

Annex 10

Amount of electronic wastes for chosen categories of products in Uzbekistan, calculated by the method of "Market Sales"

ТН ВЭД (FEACN) / **USED VALUES**	**841810 – Fridges**	**847141 – Computers**	**851712 – Mobile phones**	**853932 – Mercury lamps**
Ls - Average lifetime of a new product (years)	10	5	3	1,5
Year of sale	2006	2012	2014	2015
N1 - National production of electrical and electronic equipment of a certain category in a year in tons	4732	0	7,7	793
Average weight per product (kg)	35	9,9	0,1	0,25
N2 - Import of electrical and electronic equipment of a certain category in a year in tons	1754	23,08	67	66,03
N3 - Export of electrical and electronic equipment of a certain category in a year in tons	0	0	0	0
N0 - National sales of electrical and electronic equipment of a certain category in a year in tons	6486	23,08	74,7	859,03
Amount of electronic wastes in tons	**6486**	**23,08**	**74,7**	**859**

Annex 11

Amount of electronic wastes for chosen categories of products in Kazakhstan, calculated by the method of "Acquisition and Use"

ТН ВЭД (FEACN) / USED VALUES	841810 – Fridges	847141 – Computers	851712 – Mobile phones
Ls - Average lifetime of a new product (years)	10	5	3
m - Average weight per product (kg)	35	9,9	0,1
hh - Number of households	4391759	4391759	4391759
r - Saturation rate of device n per household	1,03	0,44	1,55
Amount of electronic wastes in kg	15832291,2	3826100	226907,5
Amount of electronic wastes in tons	**15832,3**	**3826,1**	**226,9**

Annex 12

Amount of electronic wastes for chosen categories of products in Kyrgyzstan, calculated by the method of "Acquisition and Use"

ТН ВЭД (FEACN) / USED VALUES	841810 – Fridges	847141 – Computers	851712 – Mobile phones
Ls - Average lifetime of a new product (years)	10	5	3
m - Average weight per product (kg)	35	9,9	0,1
hh - Number of households	1145700	1145700	1145700
r - Saturation rate of device n per household	0,79	0,07	0,3
Amount of electronic wastes in kg	3167860,5	158794	11457
Amount of electronic wastes in tons	**3167,9**	**158,8**	**11,5**

Annex 13

Amount of electronic wastes for chosen categories of products in Tajikistan, calculated by the method of "Acquisition and Use"

ТН ВЭД (FEACN) / USED VALUES	841810 – Fridges	847141 – Computers	851712 – Mobile phones
Ls - Average lifetime of a new product (years)	10	5	3
m - Average weight per product (kg)	35	9,9	0,1
hh - Number of households	1 197 187	1 197 187	1 197 187
r - Saturation rate of device n per household	0,23	1,06	2,6
Amount of electronic wastes in kg	963735,5	2512656	103756,2
Amount of electronic wastes in tons	**963,7**	**2512,6**	**103,7**

Annex 14

Amount of electronic wastes for chosen categories of products in Turkmenistan, calculated by the method of "Acquisition and Use"

ТН ВЭД (FEACN) / USED VALUES	841810 – Fridges	847141 – Computers	851712 – Mobile phones
Ls - Average lifetime of a new product (years)	10	5	3
m - Average weight per product (kg)	35	9,9	0,1
hh - Number of households	896437	896437	896437
r - Saturation rate of device n per household	0,99	0,072	2,34
Amount of electronic wastes in kg	3106154,2	127796	69922
Amount of electronic wastes in tons	**3106,1**	**127,8**	**69,9**

Annex 15

Amount of electronic wastes for chosen categories of products in Uzbekistan, calculated by the method of "Acquisition and Use"

ТН ВЭД (FEACN) **USED VALUES**	**841810 – Fridges**	**847141 – Computers**	**851712 – Mobile phones**
Ls - Average lifetime of a new product (years)	10	5	3
m - Average weight per product (kg)	35	9,9	0,1
hh - Number of households	5250000	5250000	5250000
r - Saturation rate of device n per household	0,99	0,07	2,34
Amount of electronic wastes in kg	18191250	748440	409500
Amount of electronic wastes in tons	**18191,3**	**748,4**	**409,5**