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Comparative analysis of Municipal Solid Waste management in Kazakhstan and Austria

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Affidavit

I, **NARGIZ BIZHANOVA, MA**, hereby declare

1. that I am the sole author of the present Master's Thesis, "COMPARATIVE ANALYSIS OF MUNICIPAL SOLID WASTE MANAGEMENT IN KAZAKHSTAN AND AUSTRIA", 79 pages, bound, and that I have not used any source or tool other than those referenced or any other illicit aid or tool, and
2. that I have not prior to this date submitted the topic of this Master's Thesis or parts of it in any form for assessment as an examination paper, either in Austria or abroad.

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Abstract

This thesis will demonstrate the advantages and challenges of municipal solid waste management in Kazakhstan and Austria. A comparative analysis will show findings on specific characteristics of waste management in the selected countries, development of legislation systems of both countries. that have resulted in different levels of development of waste management in time and finally depict possible limits and trends. A part of this thesis dedicated to legislation will illustrate trends in implementation of specific laws on waste management of Kazakhstan and Austria. Considering importance of further development of waste management policy in Kazakhstan, Austrian system will be analyzed for best practices regarding legislation, technologies and systems in general. Recommendations on above mentioned topics will be given in this thesis. The focus of this thesis content is to highlight the disposition of the waste management sector, which is to provide conservation of environment, sustainable development for modern cities, development of efficient and clean technologies to prevent, reduce and dispose amounts of generated waste.

Keywords: waste management, municipal solid waste, sustainability, energy security, green energy, renewable energies, development, Kazakhstan, Austria

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List of Abbreviations:

MSW (municipal solid waste)
WM (waste management)
FWMP (Federal Waste Management Plan of Austria)
Economic Complexity Index (ECI)
USD (United States Dollars)
Kg (kilograms)
kg/inh/ kilograms /inhabitant
c. (circa)
i.e (*id est* / that is)
GDP (gross domestic product)
US (United States)
BRI (One Belt One Road Initiative)
UNDP (United Nations Development Program)
UNIDO (United Nations Industrial Development Organization)
OECD (Organisation for Economic Co-operation and Development)
IMF (International Monetary Fund)
WMA (Waste Management Act)
GEF (Global Environment Facility)
EC (European Commission)
DSS(Decision Support Software)
BAT (Best Available Technologies)
BA (Bank Austria)
LLP(Limited Liability Partnership)
MBT (Mechanical Biological Treatment Plant)
tn (ton, tonnes)
OPEC (Organization of the Petroleum Exporting Countries)
OMV (Österreichische Mineralölverwaltung AG)
COVID -19 (Coronavirus Disease)

1. Introduction

One of the main factors in current pollution of nature, which led to another environmental crisis, is the economic and household activities of cities. The growth of industry and population is leading to an unconditional increase in the volume of household waste. This raises the problem of competent waste disposal. As practice shows, localization of waste at landfills leads to secondary contamination of soil and the removal of significant areas from the useful turnover.

Disposal and complete disposal of solid domestic waste is a difficult hygiene problem, especially in an increasingly urbanized environment. The complexity of the problem is due to the following points: a constant increase in the mass of waste and the expansion of the range of components contained in it. Disposal and disposal of waste directly in localities is unacceptable. However, in many places, the most primitive ways to dispose of household and street waste are used: incineration in the natural environment on streets and in yards without any technical facilities, which leads to dangerous pollution of the atmosphere of residential areas. In Kazakhstan the practice of burying waste in uncontrolled landfills that is relied on the mineralization capacity of the soil is still in place. The problem cannot be solved in this way.

In recent years, research aimed at developing a framework for ensuring environmental balance has been expanding. In particular, the quantitative and qualitative characteristics of solid waste that can lead to disruption and degradation of natural systems in residential areas are analyzed. Due to very slow decomposition, solid waste accumulates on the planet very intensively. Waste situation is becoming a crisis. And it is natural that the search for ways and means to deal with waste has become particularly important. A comprehensive solution to the problems of waste disposal is required. There is a need for data banks on waste and the methods of their processing, sectoral waste accounting, the introduction of economic incentive principles, and an appropriate legislative framework. Austria has a developed comprehensive legislative base for waste management. Kazakhstan in this regard is developing its national regulations with

a focus on green technologies and norms and principles of sustainable development.

I believe that in countries with comprehensive waste regulations, waste is better disposed. In recent years, various measures aimed at decreasing landfill sites have been tested: domestic waste is sorted, processed into agricultural fertilizer or even liquid fuel; some of the waste is taken out and used to fill quarries, ravines, etc. There are three main options for disposing of municipal solid waste: landfill and landfill management; incineration and recycling of waste.

The problem with this type of disposal method is that landfills cover huge areas around cities, and that poisons and decomposition products from landfills can penetrate groundwater and be blown by winds in surrounding areas. This is one of the problems in waste management that Kazakhstan is currently dealing with.

Many developed countries around the world, including Austria, have already coordinated their research and practice and believe that the only alternative is to minimize waste generation and direct waste to a "second life". This requires two programmes: waste management, waste prevention and the redirection of waste streams from incinerators and landfills to recycling. Recycling however requires separate collection of waste: paper, glass and organic. It should be noted that doing business in a sphere of waste management is in present not profitable in Kazakhstan. Only companies that collect solid household waste are profitable, however not the ones that recycle it. In order to develop domestic waste processing companies, the government should provide support via preferential taxes and subsidies for start-ups.

The main objective of this study is to analyze methods to improve waste management in Kazakhstan, based on the experience of Austria as a successful example with one of the most developed waste management systems. Also we will consider in detail the composition of waste and the dynamics of waste generation in the cities of the two countries. With examples of Nur-Sultan and Vienna, we will review the stages of waste processing development: how it is

distributed, the efficiency of the waste sorting method in cities, further waste recycling, as well as the types of landfills and their location. Since 1999 (seven years before environmental assessments were incorporated into legislation), waste management plans and waste prevention programmes in Vienna have been successfully developed through strategic environmental impact assessments.

One of the tasks of this thesis is to evaluate the present situations of waste management of Kazakhstan with an example of the capital of the country, providing comparative analysis between Kazakhstan and Austria to bring suggestions in order to improve situation for a future generation of the country.

Outlining the goals of my research the following should be mentioned:

- to analyze on which stage is the development of waste management in Kazakhstan, particularly on example of the capital of Kazakhstan Nur-Sultan (former Astana);
- to determine whether waste management in Kazakhstan is effectively developing;
- to identify contemporary issues and challenges Kazakhstan faces dealing with waste management;
- to conduct comparative analysis between Vienna, Nur-Sultan and partly with Almaty;
- provide recommendations and attempt to deliver possible scenarios of further development of waste management field in Kazakhstan.

It is not a secret that just two decades as an independent country, Kazakhstan has made great strides, but waste management is a problem area and a major brake on economic growth. Analysis of Austrian system of waste management on Viennese example could show effective solutions. The studies are also aimed to determine whether waste management systems currently applied in Kazakhstan are effective solutions for waste management in this country.19

2. General information about Austria

In this chapter we will present general studies on Austria in regard to economic rates, size of the country, its population and resource consumption in 2017. This

will help create an overview of the country's economic development. Austria is located in the Centre of Europe, being a part of the European Union since 1995.It is a high-income country. The population of Austria consists approximately of 9 million in 2020, as per the Worldometer elaborated based on latest United Nations data. Austria population is equivalent to 0,12% of the total world population. The population density in Austria is 109 per km^2 (283 people per m2). The total land area is 82,409 km^2 (31,818 sq. miles). 57.3 % of the population is urban (5,159,360 people in 2020). The median age in Austria is 43.5 years ("Austria Population (2020) - Worldometer" n.d.). In Vienna by the beginning of 2019 population rate was 1,897,491 (Vienna City Administration, n.d.).

GDP per capita in Austria (with a population of 8,819,901 people) was $49,066 in 2017, an increase of $823 from $48,242 in 2016; this represents a change of 1.7% in GDP per capita ("Austria GDP - Worldometer" n.d.). Diversification of the economy is one of the important factors of economic growth. According to the Economic Complexity Index (ECI) in 2018 was ranked with the 6^{th} position. Compared to a previous decade, Austria's economy has become more complex, improving 1 position in the ECI ranking. Moving forward, Austria is positioned to take advantage of a moderate number of opportunities to diversify its production using its existing know-how. The Growth Lab's 2027 Growth Projections predicts growth of income level in Austria of 2.2% annually over the coming decade, ranking in the bottom half of countries in the world ("The Atlas of Economic Complexity by @HarvardGrwthLab" n.d.).

In 2017 Austria exported products worth 250 billion USD. In the period from 2012-2017 exports have grown by an annual average of 1.6%, which has been a drag on overall economic growth. According to economic experts, export rates represent a shrinking segment of the economy. If to compare to non-oil exports within the same period, it has grown by 1.8% annually, outpacing the global average growth. In 2017 total imports reached 245 billion of USD, leaving Austria with a trade surplus in goods and services ("The Atlas of Economic Complexity by @HarvardGrwthLab" n.d.). Leading countries which Austria had actively exported goods and services to they are neighboring Germany, Italy and the United States of America with 29,55%, 6,53% and 6,25% respectively. Austria

has seen a promising pattern of export growth, large part of which was coming from high and moderate complexity products, particularly vehicles, travel and tourism products. Additionally, the list of the industries with high growth rates comprise sectors such as transport, beverages, wood. In 2017 transport showed 6,99% of shares in the export with $15.8 billions of USD. When it comes to beverages, Austria exported it in total for 2,58 billions of USD. Wood was exported from Austria to other countries in total for 4,42 million of USD.

If to talk about three main import origin countries of Austria these are Germany, Italy, Switzerland with exporting rates of 41,52%, 6,40% and 4,88% respectively. Among the products and services imported to Austria in 2017 they were information and communication technologies and transport. Tourism and travelling services are on the third place in the list of commodities and services imported to Austria. Statistics above us shows us the state of the economic development of Austria in the contemporary period, trading rates with other countries, the most developed sectors of economy.

Another important statistics to observe is resource use in the country. Resource use determines the use of domestic resources such as land, water, energy, also the emissions and wastes which generate with this use. It is not a secret that, Austria is a part of a global network of raw material use, resource consumption and environmental impacts of extraction, production and use through its connections with global economy. In this chapter I will present a brief overview of Austrian material use and the shares of domestic extraction, imports and exports with a focus on the period from 2008-2015 (Schaffartzik, Eisenmenger, et al. 2015).

From 2011-2013 an average of approximately 185 million tonnes per year of material were consumed. Domestic extraction represented 82% share of this material consumption. In comparison to the average for the decade from 2000 – 2010, material consumption dropped by approximately 7 million tonnes and domestic extraction by around 12 million tonnes. However, imports increased during the first three years of the decade from 2010 in comparison to the previous decade by 12 million tonnes and exports increased by 7 million tonnes. This

means that although there was less domestic extraction and use in Austria, overall material availability (i. e. domestic extraction together with imports) grew up by approximately 1 million tonnes.

Statistics shows that since 2008 there was a decrease of material consumption in Austria. Research showed that the rate in 2012 was with over than 10 tonnes less than in 2008. In 2012 the list of material use comprised non-metallic minerals, biomass, fossil energy carriers and metals. All these materials can be calculated in terms of per capita use by people who reside in Austria over 366 days of 2012. In average, material consumption in Austria per person per day constituted approximately 60 kg, c.8 kg/day less per capita than in 2008. On the table 1.1. shown below, material consumption by material category in million tonnes in Austria over the period of 2012 and its percentage rates are illustrated. Additionally, total amount of material use in 2012 are presented in the table below.

Table 1.1. Material use by material category in Austria in 2012 in million tonnes and as a share of total material use (Source: “Federal Waste Management Plan” 2011).

The 187 million tonnes of material that were used in 2012 represent a little over 60 kg per person and day, with more than 50% consisting of non-metallic minerals.

	Material use	
	Mt	%
Biomass	42	23%
Fossil energy carriers	28	15%
Metals	10	5%
Non-metallic minerals	107	57%
Total	187	100%

Data source: Statistics Austria 2014a

Extraction of resources also plays quite a big role for Austrian economy. However, due to the principles of sustainable development that Austria sticks to, numbers of resources extraction in this regard are decreasing from one year to another. Decline of the domestic resource extraction rates can be noticed since 2008. The main reason why domestic extraction still plays important role in

contemporary economy of the country is that since the second half of the 20th century, domestic extraction was estimated at over 80 % of Austria's overall material use. This fact means that Austrian economy shows a high demand on the resources extracted within this country and rates of export of domestically extracted resources are low. Since demand on certain types of resources at home is mostly covered by domestic supply, it means that there is a high level of supply security with those resources for Austrian economy. However, it is worth to note that economy still has a big gap in supply/demand rates for certain resources that are of a lack in the country. In this regard, they must rely completely on import of those materials. In 2012, 70 % of extracted resources contained non-metallic minerals, in particular construction minerals.

In agriculture and forestry 26 % of domestic extraction were represented by biomass, which amounted to 39 million tonnes. If to refer to metals und fossil energy carriers, it was represented with a very small share of domestic extraction, 2% per each section of all amount of extracted materials in Austria. It is not a secret that minimization of material use can lead to a cut of resource extraction, which in turn could affect after consumption, where emissions and waste are reduced.

In 2012, 30 million tonnes of primarily oil and natural gas fossil energy carriers, metals and biomass were imported in large quantities in Austria. A big amount of 21 million tonnes of metallic minerals and goods produced from them were imported. Among other goods imported to Austria in 2012 non-metallic minerals amounted in 10 million tones. In quantitative terms, Austrian imports in 2012 corresponded to over 60 % of total domestic extraction. Evidently Austrian exportplays an important role, although export flows in Austria are quantitatively smaller than imports. In overall export amounted to 55 million tonnes in 2012. Most of exported goods are more highly processed therefore obtain higher prices than less processed basic materials.

Table 1.2. Domestic extraction of material in Austria in 2012 by material category (Source: “Federal Waste Management Plan” 2011)

	Domestic extraction		Share of domestic material consumption (DMC) coming from domestic extraction
	(Mt)	(%)	(%)
Biomass	39	26%	93%
Fossil energy carriers	2	1%	9%
Metals	3	2%	26%
Non-metallic minerals	106	71%	99%
Total	150	100%	80%

In a table above domestic extraction of material in Austria in 2012 presented by material category. Comparatively high domestic extraction of biomass and non-metallic minerals accounted for almost all domestic material consumption. Contrary to this, significant share of fossil fuels and metals had to be imported.

To conclude, Austria is an exporting country. Concrete facts and figures perfectly illustrate it with the rates of around 60 per cent of the gross domestic product (GDP) that are generated by Austrian’s exporting companies and every second job is ensured by a foreign trade. Therefore, export in this country is supporting economic growth, creates jobs, ensures social security and economic prosperity. Austria is represented on a global market by such well-known enterprises like Erste Group, Voestalpine, Strabag, OMV. The top sectors that are providing high quality goods and services are banking sector, oil and gas, steel production, construction business. The number of exporters has more than quadrupled in the past 25 years from 12,000 to 58,000, a number that comprises not only large companies: small- and medium-sized enterprises account for around 80 per cent of exporting businesses in many sectors and industries.

Sustainable economic development is one of the key priorities of Austrian government. Economic policy is the important factor that influence ecological

situation of the country by providing foundation for economic conditions enabling structural changes. The main goal of sustainable development is to meet the needs of the present without compromising the ability of future generations to meet their own needs ("Our Common Future" 1987). Another important role of sustainable economy is to provide jobs and qualitative economic growth for present and future generation based on ensuring goods and services that are not dependent on use of natural resources.

The more competitive the economic environment the more requirements are in place. Sustainable development requires from companies using best available green technologies, that will bring minimum harm to the ecology of the planet.The advantages of implementing strict requirements on the basis of principles of sustainable development boosts competitiveness among enterprises. Following the environmental rules companies provide better quality of goods and services for the market and improving ecological situation not only in Austria but worldwide, due to raising export of goods and services provided by local companies.

2.1. General information about Kazakhstan

Kazakhstan is the 9th largest country in the world, geographically located in the Central Asian region. The total land area is 2,699,700 Km^2 (1,042,360 sq. miles). It is a landlocked country, however Kazakhstan shares borders of Caspian sea with other 4 countries: Azerbaijan, Russia, Turkmenistan, Iran. As it extends across both sides of the Ural River, considered the dividing line with the European continent, Kazakhstan is one of only two landlocked countries in the world that has territory in two continents (the other is Azerbaijan) ("Geography | Welcome to Astana" n.d.). Major cities are Astana, Almaty, Karagandy, Shymkent, Atyrau and Oskemen. While located primarily in Asia, a relatively small part of Kazakhstan is also located west of the Urals in the Eastern Europe.

Kazakhstan's terrain extends west to east from the Caspian Sea to the Altay Mountains and north to south from the plains of Western Siberia to the oases and deserts of Central Asia. The Kazakh Steppe, with an area of approximately

804,500 km^2 (310,600 sq mi), occupies one-third of the country and is the world's largest dry steppe region ("Geography | Welcome to Astana" n.d.). Kazakhstan is divided into fourteen regions. The regions are subdivided into districts. The cities of Nur-Sultan and Almaty are cities of "state importance" and they do not belong to any of the fourteen regions. In this dissertation focus will be mainly on the capital of Kazakhstan – Nur-Sultan (former Astana), one of the biggest cities in the country.

According to the latest statistic, population of the Kazakhstan is 18,776,803 million people, with population density of 7 per Km^2 (18 people per m^2). 57,7% of the population of the country is urban (10,828,881 people in 2020). The population of Nur-Sultan at the beginning of 2019 was 1,078,384. Small density of the country influenced formation of common habits of local people in regards to waste management. The fact of a big territory that country has and that less territories are occupied it influenced collection waste system developed in Kazakhstan.The negative part is that companies and households organized a big amount of polygons that comprised only in 2019 around 3,2 millions tonnes of unprocessed waste, only 15% of which could undergo recycling. Uncontrolled collection of all type of untreated waste causes air and water pollution, soil contamination, endangers people's health. If the government will actively raise awareness among society, integrate waste management courses in high school program, starting with simple examples of separate waste collection that could possibly encourage local people to improve current situation with waste management in Kazakhstan.

A new system of waste management can lead to reduction of the volume of waste generated on the polygons, lower the amount of incinerated waste, it could also lower consumption of goods among population. Among positive changes could also be increase of public literacy regarding waste management and sustainable development. People can learn how to separate waste, which starts from every single household. For this model to work three parties should be interested in solving ecological problems: government, public and business. At the moment in Nur-Sultan and Almaty (former capital of Kazakhstan) special yellow waste containers for the recycled materials, paper, food scraps and separate bin for

plastic are being installed. On the pictures below several types of the waste containers that were installed on the streets of Kazakhstan's cities are illustrated.

Installed containers for separate collection of municipal solid waste in Nur-Sultan. Photos are taken from archive of the author of this thesis, 2020.

Picture 1

Picture 2

If to continue about other important economic indicators, Kazakhstan's economic freedom score is 69.6, it puts a country on the 39th position in the list of countries with Economic freedom index in 2020. In countries that are on top of the list of Economic freedom index, labor, capital, and goods move freely without much of governmental control, and it excludes government invasion to the extent when it is necessary to protect and maintain liberty itself. Above mentioned factor plays an important role for attracting foreign direct investments to the country.

Country's overall score has increased by 4.2 points due to a large increase in the fiscal health score. Kazakhstan is ranked 10th among 42 countries in the Asia–Pacific region, and its overall score is well above the regional and world average. Kazakhstan is an upper-middle-income country, ranking as the 51st richest economy per capita out of 133 studied. Its 18.3 million inhabitants have a GDP per capita of $9,814 ($26,172 PPP; 2018). GDP per capita growth has averaged 1.5% over the past five years, above regional averages. Significant increase in annual GDP growth was observed in 2017, it went up from 1.1% to 4.0% in 2016

and 2017 respectively. The slight increase in oil and metal market prices in 2016-2017 caused growth in the economic performance of the country. Increase of trade of Kazakhstan with the European Union, China and Russia was noticed in this period as well. Kazakhstan continues its work on the ambitious goal of achieving OECD standards within the framework of the OECD Kazakhstan Country Program, that was launched in 2015 and renewed in November 2018 ("Assessment of the Public Procurement Systems of the Republic of Kazakhstan and the Sovereign Wealth Fund Samruk Kazyna" 2019).

If to refer to resource consumption indicators, according to the latest available statistics, in 2016, Kazakhstan had a 27.71% lower domestic material consumption (DMC) intensity compared to 2000. This indicates decrease of material resources used per unit of economic output, implying improvement of resource efficiency over this period. In 2016, Kazakhstan was less resource efficient in terms of usage of material resources compared to the Asia-Pacific regional average. In comparison with other Central Asian countries average domestic material consumption Kazakhstan's rate showed 0.97 kg more.

In the energy consumption, according to the latest available statistics, in 2015, Kazakhstan had a 21.44% lower energy intensity compared to 2000. This indicates a decrease of energy usage per unit of economic output, implying improvement of resource efficiency over this period. In 2015, Kazakhstan was more resource efficient in terms of energy usage compared to the Central Asian regional average, with average energy intensity of 189.23 of oil equivalent per 1000 dollars GDP (2011 PPP) in 2015 and 196 (Kg of oil equivalent per 1000 dollars GDP (2011 PPP)) in 2015 respectively.

In regards to economic complexity Kazakhstan is positioned as an economy with low level of exporting diversification, which means that our economy still remains dependent on the export of natural resources. Since 2018, according to the ECI ranking, Kazakhstan has not improved its position, which means the country has not made a positive change in regard to economic complexity but has diversified into lower complexity products. Furthermore, Kazakhstan is positioned to take advantage of a few opportunities to diversify its production using its existing

knowhow (“The Atlas of Economic Complexity by @HarvardGrwthLab” n.d.). I believe that Kazakhstan has significant potential of diversification of the economy and it has a good investment climate, which the government has been reforming to make Kazakhstan attractive for foreign investments. Since the country geographically located in a heart of Eurasia and it is considered one of the advantages. Kazakhstan strategically links the large and fast-growing markets of China and South Asia and those of Russia and Western Europe by road, rail, and a port on the Caspian Sea (“Overview” n.d.). Hence, transport and infrastructure is the most developing and one of the most promising areas of country’s economic development. One Belt One Road initiative is the biggest project of last century focused on connecting Asian world with Western countries and building stronger economic relations. In the six and a half years since the Belt and Road Initiative was launched, more than a hundred Asian, European, Middle Eastern, and African states and dozens of international organizations have joined it in one way or another (Nurgaliyev 2020). This initiative of our Chinese partners goes in harmony with Kazakhstan’s project “Nurly Zhol” launched with an aim to build new infrastructure. The harmony of Nurly Zhol and BRI is determined by the fact that both megaprojects prioritize transport, logistics, industry, energy, agricultural exports, housing, communal infrastructure, education, human capital development, and support for small and medium-sized businesses. Of particular importance for our country is the creation of transport corridors “China-Kazakhstan-Russia-Western Europe,” “China-Kazakhstan-Western Asia,” “China-Kazakhstan-South Caucasus/Turkey-Europe” within the BRI. With the boost of infrastructure, it will have a positive impact on improving waste management system of the country, especially in terms of connecting big cities with outskirts without necessary facilities for collecting waste from households.

3. Framework of waste legislation in Austria

The core legal instrument on waste management of Austria is the Waste management Act 2002. Every 5-6 years it is obligatory for the Federal Minister of Agriculture, Forestry, Environment and Water Management of Austria to draft a Federal Waste Management Plan. If to refer to the definition of waste, there are different criteria that are provided in the Federal Waste Management Plan 2017.

Among them there are mobility, by-products etc. According to European Court of Justice case law on the definition of waste the concept of waste should not be narrowed. It is claimed that waste must be examined in a light of all the circumstances, taking into account the aims of the Framework Directive on waste ("Federal Waste Management Plan" 2011). According to the Framework "waste" means any substance or object which the holder discards or intends or is required to discard (European Parliament, Council 2008). Considering that Austrian legislation on waste reflects mainly the strategy of the European Union regarding waste management, main purposes of the Austrian waste management policy are implemented from the EU law.

This Directive also describes objectives of waste management of the EU countries which includes following: minimization the negative effects of the generation and management of waste on human health and the environment. Waste policies of the EU states should also aim at reducing the use of resources, and favour the practical application of the waste hierarchy (European Parliament, Council 2008). Following priorities stated in the Directive that are considered as a basis for waste management such as waste prevention, re-use, and material recycling should be considered as a preference to energy recovery from waste. As one of the effective solutions in this regards polluter pays principle could be considered, which was implemented set out in the Treaty on the Functioning of the European Union and Directive 2004/35/EC of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage is based on this principle (Wikipedia Contributors 2019). Implementation of this principle helps to fulfill the goals such as waste prevention, re-use, and recycling.

The main legislative act regarding waste management in Austria is Waste Management Act 2002 (*Waste Management Act* 2002).The first five objectives in the Act relate to no harm effect to health of humans, animal, and plants, and decreasing negative effects to a minimum. In this regards it is the EU main principle of waste management successfully implemented in Austria and remain as an underlying strategy. Keeping low greenhouse gas emissions that negatively affect climate and environment is the second aim stated in the WMA. Resource

conservation is the next prominent goal of Austrian waste management, considering the fact how much energy and other resources it is required to extract natural resources. Production of energy out of waste is the way to help solving the problem of resource conservation. This could be a successful case for those developing countries with economy that is based primarily on extracting and importing raw materials.

Another goal stated in the Waste Management Act of Austria implies controlling quality of recyclables, meaning that the waste or the substances obtained from it have no higher hazard potential than comparable primary raw materials or products made from primary raw materials. That method of quality control prevents increasing of rate of potentially hazardous elements in commodities that society uses in a daily life. Last but not the least among main objectives of waste management is that only those wastes remain whose disposal poses no threat to future generations.

Fulfilment of these objectives do require a system that makes the process manageable, and in the Federal Waste Management Act there is such a system as hierarchy. It is being represented with a following: waste prevention, preparation for reuse, recycling, other recycling (e.g. energy recovery), and finally disposal. The hierarchy was introduced on the EU level in the Waste Framework Directive as a main strategy to reduce the amount of waste, along with decreasing hazardous effect of the waste (European Parliament, Council 2008). Waste prevention method is closely related to improving manufacturing methods, which means introducing new green technologies into economics of the country. Another tool of waste prevention method is to make society switch to sustainable consumption, choose ecological products, less packaging. Studies showed that the more economy is developed there is a common trend of increasing packaging when it comes to municipal solid waste.

Table 3.1. Volume of packaging waste in Austria in tonnes (Source: “Federal Waste Management Plan” 2017)

	Volume [t]				
Packaging material	2011	2012	2013	2014	2015
Paper, paperboard and cardboard	501,978	516,420	518,101	542,419	553,267
Glass	271,999	271,292	272,639	272,676	274,485
Metal	62,515	63,905	57,400	55,982	56,840
Plastic	264,152	271,808	288,714	291,968	294,888
Wood	91,170	88,265	89,820	93,338	89,352
Other	40,245	41,884	45,022	47,145	42,414
Total	1,232,059	1,253,574	1,271,696	1,303,528	1,311,246

If to refer to statistics of Austrian municipal solid waste we could see an increasing trend of packaging. This includes different materials such as paper, wood, glass, including plastic one, significant portion of which belongs to the food catering packaging.

According to the Directive on Waste Management, the term “re-use” means any operation by which products or components that are not waste are used again for the same purpose for which they were conceived. There is also a process of preparation for re-use defined in the Directive, which is explained in a following way as the “process of checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be re-used without any other pre-processing” (European Parliament, Council 2008). This rational method perfectly represents main idea of sustainable consumption, which should be implemented in a daily life of consumers especially of those developing countries who struggle and suffer from issues in waste management. From this example we could see simplicity and convenience of sustainable consumption.

One of the last steps in hierarchy is recycling and other recycling. Recycling is an energy consuming process that usually requires transportation of waste, human resources and a lot of financial means. All of these factors make the process of recycling not always feasible for the countries who can afford and implement this

method of waste management. As it is stated in the Waste Management Act, ecological feasibility and technical feasibility should be taken into account, as well as the fact that the additional costs incurred are not disproportionate to other waste treatment methods and that a market for the substances or energy obtained is or could be established. When it comes to the recycling of municipal solid waste we can observe dramatic raise of recovering plants from 48 to 101 in 2011 and 2017 respectively ("Federal Waste Management Plan" 2011). This is in line with goals stated in the Waste Management Act and hierarchy system of Austrian waste management.

Finally, disposal as a last point of the hierarchy should finish the system of prevention of waste. In accordance with the European Directive, term disposal is clarified following way "any operation which is not recovery even where the operation has as a secondary consequence the reclamation of substances or energy".

Waste prevention and recycling part of the Waste Management Act comprise regulations for the companies which generate waste during operation and employ more than 20 persons. To specify it they are aims of sustainable waste prevention, waste management concept, waste management officer, obligations concerning motor oils and oil filters, obligation to notify mail order companies, measures for waste prevention and recycling. Next part of the Act is general obligations of waste holders. Delivery and transport of hazardous waste are the special procedure with specific requirements to declare detailed information on the hazardous waste like type, volume, special risks that may be associated with the treatment must be made known as well. Chapter dedicated to waste collectors and handlers regulates norms and procedures on the permit for the collection or treatment of hazardous waste. The next step of the regulations of waste management reflected in the Waste Management Act of Austria 2002 is the collection and recovery systems. It contains procedures like authorisation of collection and recovery systems, compensation, supervision, obligations for near-household collection and recovery systems. The Federal Minister of Agriculture, Forestry, Environment and Water Management of Austria has obligations to set up a committee of experts to support the inspection of collection and recovery

systems close to households. This has to be composed of a chartered accountant, a waste management expert and a legal expert committee of experts, advisory board, supervision of abuse of near-household collection and recovery systems, more detailed provisions for collection and recovery systems. As we can see requirements and standards for collection and recovery systems are high and both systems have comprehensive approach. An efficient treatment of waste is the priority for Austria, therefore government set up certain requirements for stationary waste treatment plants that are mentioned in the Act. Starting from concentration and responsibility and ending up with provisions for a change of the owner of a treatment plant.

When it comes to landfilling, the whole process is regulated by the Waste Management Act. Requirements starts with the analysis of the soil, supervision of the construction of a landfill. According to the law all the expenses have to be incurred by the owner of a landfill.

Shipment of the waste is also being regulated in the Waste Management Act in cases there are shipments of waste to, from or through Austria. This is subject to notification under the EU Shipment Regulation. The Federal Minister of Agriculture, Forestry, Environment and Water Management is responsible for the decisions on the any shipment of waste.

Scope of application and procedural provisions on shipment of waste contain notification on export, notification documents, authorisation requirement for import, export and transit, provisions of security and carriage, obligation to re-import, detailed provisions for transboundary movements.

Chapter 8 of the Waste Management Act contains provisions on treatment of the waste with focus on the following cases when waste is not collected, stored or treated in accordance with the provisions of this Federal Act or of ordinances issued pursuant to this Federal Act, if waste is not transported or shipped in accordance with the provisions of this Federal Act or of the EU Waste Shipment Regulation. In the situation when harmless treatment of the waste is necessary to prevent harm to public interests, in accordance with the Federal Act the

authority shall take necessary measures, including the prohibition of unlawful acts, to order the obligated party by notice.

Deposition of waste is also is under control of Austrian authority. It is outlined in the Waste Management Act, where specific requirements on the type of waste that could be deposited to the landfills. The authority may determine by notice to what extent the authorised or licensed waste corresponds to the notified landfill type. Furthermore, the authority may, by means of an official decision, permit that the waste corresponding to the previous consensus may be disposed of after pre-treatment in accordance with the state of the art, if this corresponds to the selected landfill type and no adverse effects on the interests to be safeguarded pursuant to Article 43 are to be expected; the disposal of such pre-treated waste may only take place if the adaptation of the landfill to the state of the art pursuant to paragraphs number 1 and2 has been completed.

Chapter 9 of the Waste Management Act 2002 describes the process of adaptation of landfills to the Landfill Ordinance 1996. The final Chapter 10 of the Act describes final provisions on penalties.

3.1 Framework of waste legislation in Kazakhstan

Waste management in Kazakhstan is regulated by the Environmental Code of Kazakhstan and relevant amendments as of 17.07.2009 and a number of other orders and resolutions relevant to Sanitary Rules, such as the Order of the Ministry of Health of the Kazakhstan № 555 dated 28.07.2010 on the approval of Sanitary Rules and the Resolution of the Government of the Republic of Kazakhstan dated March 6, 2012 № 291 on the approval of the Sanitary Rules. Recently, the Program of Modernization of Municipal Solid Waste Management for the years 2014-2050 was issued by the Ministry of Environment and Water Resources (2014). The program is based on the act № 577 of 30/05/2013 entitled “Concept of transition of Kazakhstan to a Green Economy”, and the act № 750 of 06/08/2013, which is the action plan of the Government of Kazakhstan to implement this concept. The Program of Modernization of Municipal Solid Waste Management for the years 2014-2050 is considered as one of the priority areas

for implementation of Green Economy program. This program aims to increase efficiency, reliability, environmental and social acceptability of MSW collection, transportation, processing and disposal services. According to the plan the target for MSW recycling is up to 40 % by 2030 and 50 % by 2050 and storage of residual MSW volumes at environmentally friendly and sanitary landfills to increase to 100 % by 2050. Also, the plan is to introduce a household waste separation program for consumers, implement the principles of a manufacturer's extended liability to develop a mechanism to attract investments, and update MSW recycling and storage standards using new technologies, such as anaerobic digestion, composting and biogas.

The environmental legislation of Kazakhstan is based on the core legal document the Constitution of Kazakhstan. It is outlined in the Environmental Code of the country itself. The present Code defines the legal bases of the state policy in the field of environmental protection, ensuring a balanced solution of social and economic problems, preservation and restoration of the environment, biological diversity and natural ecological systems in order to meet the needs of present and future generations, to ensure environmental security. Interaction between stakeholders such as ministries, civil society, schools is playing a crucial role in conserving and protecting the nature and environment. That is outlined in Article 5 point 10 as "cooperation, coordination and transparency of the activities of the government bodies for the environment protection", "the availability of environmental information" for public access. All necessary information is presented on the official web site of the Ministry of Ecology, Geology and Natural Resources of the Republic of Kazakhstan, where all the projects being launched are published as well. It is a valuable information, that provides society state of art of country's development in the sphere of ecological protection, sustainable development. It also plays a significant role to provide transparency and adequate assessment of the projects and raise awareness of the problems that country faces in the sphere of waste management. Once the problem is on the agenda of the country and people are aware of the issues, it is easier to improve the situation and find solutions of the problem.

The basis of the Code is focused on providing a supportive environment for human life and health by government, development of country's natural resources and the assertion of national interests in the utilization of natural resources and the environmental modification. Other important areas of the Code are development of sustainable production and consumption, as well as a global partnership in aid of conservation, protection and rehabilitation the health and integrity of the Earth's ecosystem. It includes collaborative work with international organization like UNICEF, UNIDO, UNEP and other branches of the UN as well as intergovernmental projects between Kazakhstan and EU countries for example.

Technical regulation in the field of environmental protection, impact assessment on the environment, impact statement, environmental permit and environmental audit procedures are determined in the Environmental Code. According to the Code providing environmental safety and conservation of ecosystems and biodiversity are one of the main purposes of ecological regulation. As a young country being at the stage of transition economy Kazakhstan is seeking for the most developed system of the environmental protection as a working system to be implemented.

As an example of intragovernmental cooperation on sustainable development strategy we could take gasification project of the capital ("About the Project - Sustainable.Eep.Kz" n.d.)that is meant to decrease level of emissions to atmosphere from households and industries in the country. The project is a part of a policy on developing sustainable cities in Kazakhstan that is being implementing since 2015. The primary goal of the Sustainable Cities for Low-Carbon Development project is to develop and implement activities in various urban sectors in the pilot cities of Kazakhstan – Nur-Sultan, Almaty, which will lead to a reduction of carbon emissions, as well as improve the quality of life in the country. It is a joint program between government of the Republic of Kazakhstan in cooperation with the Global Environment Facility and the UNDP. Such projects have high potential and should attract investments in this field. Gasification of the capital is a historic project of the First President of Kazakhstan

Nursultan Nazarbayev. A large-scale work has been carried out and over a thousand kilometres of the Saryarka gas pipeline have been laid from the southern regions to the capital Nur-Sultan. Gasification will not only improve the environment, which will have a positive impact on the living conditions of residents (Akimat of Nur-Sultan).

If to refer to the European experience in regards to determination of the environmental impact assessment it is reflected in Directive 2011/92/EU of the European Parliament and of the Council as follows: The environmental impact assessment shall identify, describe and assess in an appropriate manner, in the light of each individual case and in accordance with Articles 4 to 12, the direct and indirect effects of a project on the following factors:

(a) human beings, fauna and flora;

(b)soil, water, air, climate and the landscape;

(c)material assets and the cultural heritage;

(d)the interaction between the factors referred to in points (a), (b) and (c).
This document identifies competent authorities, public, public concerned, affected member state, in case a project is likely to have significant effects on the environment of 3rd party, as the main actors in this process.

In the Code of Kazakhstan (*Environmental Code of the Republic of Kazakhstan* 2007) the definition of Environmental Impact Assessment (EIA) is indicated as a procedure that evaluates the possible consequences of planned economic and other activities for the environment and human health, develops measures to prevent adverse effects (destruction, degradation, damage and depletion of natural ecological systems and natural resources), and improves the environment, taking into account the requirements of environmental legislation of the Republic of Kazakhstan. The Code defines the boundaries of the environmental impact assessment process in accordance with the current economic development of the country. In addition, the document contains stages

of the impact assessment on the environment, the procedure of impact assessment on the environment, types of actions to be taken into account in the procedure of impact assessment on the environment. According to the Environmental Code of Kazakhstan there are 3 types of environmental impact assessment: state environmental expertise, public environmental expertise; environmental impact assessment of project.

Concerning the waste management, the Code contains the national cadaster of management of waste product and consumption. It is a systematic, based on geographic information systems, replenished and adjusted periodically set of uniform data for every types of waste, its origin and physic-chemical properties (including the risk to people and the environment), the component composition, qualitative and quantitative, technical, hydrogeological and environmental conditions, storage, disposal and discharge, technology use and processing. State controls the waste disposal of all kinds; it is also stated in the national legal document. The purpose of the cadaster is to ensure governmental entities, interested individuals and legal parties with information for the assessment, forecasting, development of technological, economic, legal and other decisions for environment conservation and management of national integrated waste control strategy. The Article 153 of Chapter 19 of the Code reflects the objective of maintaining national, regional and sectoral information and expert systems and databases on waste characteristics and recycling technology.

One of the important areas of economic development at this stage is transition to a “green economy”. The EXPO-2017 with Green Energy topic followed by other important events shows the seriousness and commitment of implementation of this concept. Concept of the transition of Kazakhstan to a Green Economy lays the foundations profound systemic changes in order to switch to a new form of economy by improving the welfare, quality of life of the population of Kazakhstan and the country's entry into the top 30 most developed countries in the world, while minimizing the impact on the environment and the degradation of natural resources. In this regard, Austria is one of the most effective countries to cooperate in this field. On its 20th Anniversary Nur-Sultan gave an impetus to the development of “green" technologies in Kazakhstan, all its regions, offering new

ideas and discovering new horizons using the progressed Austrian technologies for implementation of targets set out by the First President of Kazakhstan Nursultan Nazarbayev.

Following the Concept, there are plans to obtain energy from processing waste, "waste to energy" program. Kazakhstan is considering the possibility of implementing the Waste-to-energy project, which implies the introduction of principles for the processing of municipal solid waste into energy. One of the parties to this project is International Center for Green Technologies and Investment Projects together with the Ministry of Energy of Kazakhstan. The Waste-to-energy project is being implemented in Kazakhstan for the first time. It involves the study of the morphological composition, physico-chemical properties and energy parameters of solid waste at landfills of Kazakhstan. To implement the project, it is necessary to conduct research on feasibility of that kind of project its efficiency. Development of such project includes construction of new facilities, in particular waste treatment plants based on new technologies. Studies on realization on one of the "waste to energy" project was conducted in Almaty with participation of Mitsubishi Heavy Industries Environmental & Chemical Engineering Co., Ltd.EX Research Institute Ltd. Clean Association of TOKYO 23 (Mitsubishi Heavy Industries 2014).

According to the Concept of transition of the Republic of Kazakhstan to a Green Economy approved by the Decree of May 30, 2013, policy of Kazakhstan in the area of waste management is aimed at developing the sector of waste recycling to obtain products from recyclable material (Kaliaskarova et al.). The Concept lays the foundation for sustainable development of Kazakhstan by improving the quality of the environment, the quality of life of the population, improving the welfare of Kazakhstan and joining the top 30 most developed countries in the world. The main priorities for the transition to a green economy, facing the country, are:

- improvement of the efficiency of resource use and management (water, land, biological, etc.);
- modernization of existing and construction of new infrastructure;

- improving the well-being of the population and the quality of the environment through cost-effective ways of mitigating environmental pressure;
- improving national security, including water security;

The Concept of transition of Kazakhstan to a Green Economy is being implemented in three stages:

1. 2013-2020 - During this period, the main priority of the state will be to optimize the use of resources and increase the efficiency of environmental protection activities, as well as the creation of "green" infrastructure;
2. 2020-2030 - On the basis of the "green" infrastructure, the transformation of the national economy focused on the careful use of water, promotion and stimulation of development and wide introduction of renewable energy technologies, as well as construction of facilities based on high energy efficiency standards will begin;
3. 2030-2050 - Transition of the national economy to the principles of the so-called "third industrial revolution", requiring the use of natural resources, provided that they are renewable and sustainable.

According to the Concept, measures for transition to a "green economy" will be implemented in the following areas: sustainable use of water resources, development of sustainable and highly productive agriculture, energy saving and energy efficiency, development of the electric power industry, waste management system, reduction of air pollution and preservation and effective management of ecosystems. According to calculations, by 2050 the reforms within the framework of "green economy" will allow to increase GDP by 3%, create more than 500 thousand new jobs, form new branches of industry and services, ensure high standards of quality of life for the population everywhere. (“Concept of transition of Kazakhstan to a Green Economy” 2013).

In line with the global desire for inclusive and sustainable growth, Kazakhstan has adopted national and regulated development programmes and strategies to create the prerequisites for sustainable development. Kazakhstan was the first

country in Central Asia to establish a legal and institutional framework for the transition to green growth through the adoption of a number of legislative documents, including the Environmental Code (2007), the Law on Support for the Use of Renewable Energy Sources (2009), and the Concept of transition of Kazakhstan to a Green Economy (2013). The authorities have established effective relations with numerous international financial institutions and strategic partners about the promotion and development of renewable energy, clean technologies and infrastructure. Moreover, Kazakhstan promotes international cooperation for sustainable development through the Green Bridge Partnership Program (GBPP). (World Bank, Samruk Kazyna 2018).

Kazakhstan faces certain socio-economic and environmental challenges, such as dependence on exports of natural resources, raw materials. Today we could observe significant decline in oil prices that are regulated by OPEC countries. Member states are not always able to agree on the matter of oil production, hence prices are volatile. Nowadays pandemic is another factor that influences world economy. Kazakhstan's economy is dependent on oil prices, therefore in order to decrease this dependence it makes a priority for the country to develop their own production potential and implement new technologies. Environmental challenges include water scarcity, pollution caused by use of natural resources, high energy consumption, unsustainable agricultural practices and food security issues, as well as problems in waste management.

To date, the Government of Kazakhstan has adopted a number of development strategies and programs and action plans aimed at sustainable growth, but it is clear that fundamental problems remain unresolved, while efforts at regional cooperation are limited in terms of their effectiveness. Addressing and overcoming environmental, social and economic issues will require the adoption and implementation of comprehensive government policies and cooperation among regional authorities (World Bank, Samruk Kazyna 2018).

Goals and targets of the green economy of the Concept of transition of Kazakhstan to a Green Economy towards recycling of waste are:

- coverage of the population by removal of solid domestic waste of 100% by 2030;
- 95% of sanitary waste storage by 2030;
- to reach 40% share of recycled waste by 2030.

The transition to green growth will require effective coordination among authorities, national and international investor, business and society as a whole. As a result, the joint implementation of public policies will lead to dynamic and sustainable economic growth that will be resilient to adverse economic and environmental changes.

If the programme budget is viewed in terms of solid waste processing, about 4% of the country's GDP is planned to be spent for this purpose in a period from 2020 to 2024 (World Bank, Samruk Kazyna 2018).

3.2. Specific waste laws in Austria

According to the Austrian constitution the responsibility for municipal waste management is split between the federal and provincial governments. The Federal Ministry of Agriculture, Forestry, Environment and Water Management of Austria is responsible for the required country-wide provisions. The federal government has issued a number of ordinances for specific waste streams as well as waste treatment methods. Waste Management Act 2002 is a primary legal document that lays a base for waste management in Austria. There are number of waste ordinances that are focused on specific area of waste management.

Austrian waste management facilities are partly governed by waste legislation and partly by commercial law. In this chapter I will focus on following ordinances:

- Landfill ordinance 2014
- Ordinance on incineration of waste
- Packaging ordinance 2014-07-22
- Packaging differentiation ordinance 2015-01-28

- Waste treatment obligation ordinance 2017-04-07
- Recycling building material ordinance 2015-06-29
- Waste wood recycling ordinance 2012-05-15
- Waste registration ordinance 2008-12-23
- Ordinance on mobile facilities for the treatment of waste 2002 -12-17
- Waste list ordinance 2003-12-23
- Waste transport ordinance 2006-06-29

Directive 1999/31/EC on the landfill of waste regulates how waste is landfilled. The Landfill Directive entered into force on 16th July 1999 and Member States were required to transpose it into national legislation by 16th July 2001. Austrian Ordinance of the Federal Minister for the Environment on the Landfill of Waste (Landfill Ordinance, Verordnung des Bundesministers für Umwelt über die Ablagerung von Abfällen (Deponieverordnung) was issued in 1996 and entered into force in 1997.

In 2004 the Landfill Ordinance was amended. The present Ordinance by the Federal Minister for Agriculture and Forestry, Environment and Water Resources introduces some amendments to the Landfill Ordinance (Änderung der Deponieverordnung).

In the Landfill Ordinance of 1996 (Deponieverordnung) for the purposes of the Regulation, the following terms are defined: a batch of waste, similar waste, a solidified waste, construction waste. A term of a landfill is also explained in the text of the Landfill Ordinance.

Section 4 of the Landfill Ordinance describes 4 different types of landfills such as excavated soil landfill, construction waste landfill, residual waste landfill,bulk waste landfill. Other parts of the Landfill Ordinance contain information on assignment of waste to landfill types, waste quality and incoming inspection, specific provisions on overall assessment and requirements for the landfill site. According to the requirements for the landfills particular types of places are prohibited for landfill construction like protected mineral spring areas, flood runoff areas, sites threatened by mass movements that endanger landfills (e.g. slope movements, landslides, subsidence and avalanches). In following parts of the

Landfill Ordinance specific regulations for site exploration and investigation are described in terms of geotechnical requirements. To summarize the Landfill Ordinance Austrian government has developed a law which provides for a comprehensive approach to the preparation of construction and the further operation of the site, in accordance with environmental legislation.

Next important Ordinance I would like to refer to is the Ordinance on incineration of waste by the Federal Minister for Agriculture and Forestry, Environment and Water Resources and the Federal Minister for Economy and Labour. The goal of this Ordinance is to protect the life and health of population from adverse effects from incineration of waste, arrange incinerators in such a way that emissions are as low as possible, produce and use energy efficiently, avoid the incineration of metals. Ordinance on incineration consists of 21 articles divided into 4 chapters that reflect purpose of the Ordinance; application forms; emission threshold values; other than normal conditions and 6 Annexes in the end of the Ordinance.

Coming to the regulation on packaging the Packaging Ordinance of Austria 2014 entered into force in1 January 2015 and replaced the Packaging Ordinance 1996. The new EU packaging definition (reflected in Section 3 line 1 and Appendix) has already been in force since 23 July 2014. Previous Packaging Ordinance 1996 was expanded in terms of scope of application for packaging material.

When it comes to new regulations following was added to the previous Packaging Ordinance the import of service packaging material and/or packaged goods is already considered to be put into circulation. Household packaging should be collected in accordance with a mandatory collection system. Strict separation with respect to both household packaging and commercial packaging and thus increased expenditure on account of the Packaging Classification Ordinance. Additional expenditure in terms of packaging put into circulation through distance selling (both in Austria and abroad). Shorter registration periods (Information on the Austrian Packaging Ordinance 2014). The purpose of the Packaging Ordinance is to promote waste prevention and to prepare packaging for the reuse and recycling. Protection of human beings and the environment is the priority that

was set up in the Ordinance. Therefore, government included restrictions on hazardous substances in packaging material.

In order to clarify what is the packaging a definition of this term and the type of packaging are given in the Packaging Ordinance. Provisions on circulation packaging material are included as well. In the text the term of “primary obligated parties” as well as their functions are described in detail. Additionally, regulations for commercial packaging, transferring obligation to a collection and recycling system, system of participation by downstream and upstream levels. Metaphorically speaking, upstream production represents all activities including gathering the materials required to create a product. The upstream means processes that involve searching for and extracting raw materials. Packaging Ordinance also includes obligations for "self-fulfillers", final distributor of commercial packaging. This term refers to the condition when no collection and recycling system for commercial waste is used.

Conditions for entities putting only minor quantities into circulation are described in the Packaging Ordinance, as well as types of packaging that suppliers can hand over to major accumulation points. Liabilities of original importer are included in the document. Additional measures and special regulations are added to the amended Austrian Packaging Ordinance. Detailed description of prohibitions regarding disposal of packaging for end consumers are given in the text.

A year later in 2015 Ordinance on establishing separation of household packaging and commercial packaging was issued by the Federal Minister of Agriculture and Forestry, the Environment and Water Resources. This Ordinance implements the Waste Management Act 2002 and the European Parliament and Council Directive 94/62/EC on packaging and packaging waste of 31 December 1994. Main goal of the Ordinance is to differentiate household packaging from commercial packaging. This helps to avoid conflicts between the parties required to collect and recycle packaging. The text consists of 7 articles: goal, allocation to product groups, determination of shareholders, fulfilment of obligations,

implementing Union law, notification, Entry into force and expiration of the Directive.

One of the latest waste Ordinances is Waste Treatment Obligation Ordinance. The present Ordinance contains provisions regarding treatment of waste. Ordinance is made to ensure the environmentally friendly collection of waste, establish minimum requirements for the collection, storage and treatment of waste. The Ordinance applies to hazardous and non hazardous waste. The text consists of 34 articles, 9 parts and one Annex enclosed. Following are those 9 parts of the Ordinance:

1. General provisions
2. Electric and electronic equipment ;
3. Batteries;
4. Solvents and solvent-containing waste, paint and varnish waste;
5. Waste harmful to health and medical waste;
6. Amalgam containing waste;
7. PCB-containing waste;
8. Requirements for the storage of fermentation residues from biogas plants using waste;
9. Transitional and final provisions.

The list of specific waste laws in Austria is complimented by the Waste Wood Recycling Ordinance that was issued by the Federal Minister of Agriculture and Forestry, the Environment and Water Resources on recycling of used wood in timber industry. This Ordinance implements the Waste Management Act 2002. The text of the Ordinance contains 10 following articles:

1. Purpose;
2. Sphere of application;
3. Definition of terms
4. Duties of waste holder;
5. Initial control of used wood;
6. Recycling in timber industry
7. Ban of recycling;
8. Requirements for waste wood;

9. Transitional provisions;
10. Entry into force.

The Waste Wood Recycling Ordinance is aimed at ensuring harmless conditions for humans and the environment when it comes to the process of recycling of waste wood in the wood material industry. Another aim is to make sure that from recycling the risk is not higher than from similar products made of primary raw material. Process of recycling should not accumulate pollutants. Present Ordinance also includes following purposes: process of recycling should not accumulate pollutants; promotion of source sorting, processing suitable waste wood in the timber industry in accordance with a hierarchy described in the Waste Management Act 2002.

Following Ordinance from the list I would like to present is the Recycling Building Material Ordinance issued by the Austrian Federal Minister of Agriculture and Forestry, the Environment and Water Resources on obligations concerning construction and demolition activities, separation and treatment of waste during construction, production and waste of recycling building material. This Ordinance implements the Waste Management Act 2002. The aim of the present Ordinance is to promote the recycling and material efficiency. The point is to prepare building materials for re-use in order to ensure high quality of recycled building material in accordance with the EU law targets. The present Ordinance consists of 19 articles divided into following 6 Parts:

1. General provisions;
2. Obligation during construction and demolition activities;
3. Production and use of recycled building materials;
4. End-waste of recycled building material;
5. Specifications for the further processing of certain recycled building materials and the use thereof;
6. Final and transitional provisions.

Waste Registration Ordinance that entered into force in 2009. The Ordinance is aimed to:

1) introduce a general waste registration system in the whole territory of Austria; 2) improve the planning of waste management and disposal in general; 3) support

competent authorities in their controlling and monitoring activities; 4) reduce administrative work by introducing an electronic data bank; 5) survey of data on waste. The Ordinance consist of 12 articles: objectives, sphere of application, recording of data, electronic data, issuing of annual waste balance, provisional provisions, relationship to other Ordinances, enforcement of EU-directives and entry into force. Complimentary to the law on registration of waste there is Ordinance on annual registration of waste.

There are two Ordinances that lay base related to waste transport issues. Waste Transport Ordinance that entered into force in 2006 contains provisions regarding transportation of waste, its collection and supply. Following spheres are mentioned in the Waste Transport Ordinance that are following: application, definition of terms, nature and number of waste containers, disposal of waste, duty to notify on behalf of local authorities and entry into force. The Ordinance consists of 9 articles.

The present Ordinance lays down provisions relating to the supply, collection and transportation of waste. The text deals with the following matters: sphere of application, definition of terms, nature and number of waste containers, disposal of waste, duty to notify on behalf of local authorities and entry into force. This regulation contains 9 articles.

Another specific regulation regarding waste transport is the Ordinance on mobile facilities for the treatment of waste 2002. Present regulation has provisions relating to mobile plants for the treatment of waste. The text of the Ordinance consists of 2 articles, and the second Article names mobile facilities that need authorization.

Last but not the least and one of the essential documents on waste management is the Waste List Ordinance 2006. The present Ordinance introduces into Austrian national legislation the European Waste List. The said Ordinance establishes which waste is to be considered as hazardous bringing negative effect to human beings, flora and fauna and environment in general. The legal act also represents a code for different types of waste and its criteria in

accordance with the code. The text of the Waste List Ordinance consists of 7 articles and 5 Annexes, which are:

1. Adoption of European List of Waste;
2. Scope and obligated party;
3. Definitions
4. Hazardous waste
5. Application of Annexes 1, 2 and 5 to this Regulation
6. Implementation of acts of the European Community
7. Entry into force

Finally there is the Ordinance by the Federal Minister for Agriculture and Forestry, Environment and Water Resources on annual registration of waste.

The purpose of the present Ordinance is to: 1) introduce a general waste registration system in the whole territory of Austria; 2) improve the planning of waste management and disposal in general; 3) support competent authorities in their controlling and monitoring activities; 4) reduce administrative work by introducing an electronic data bank; 5) survey of data on waste. The text – consisting of 12 articles – deals, inter alia, with the following matters: objectives, sphere of application, recording of data, electronic data, issuing of annual waste balance, provisional provisions, relationship to other Ordinances, enforcement of EU-directives and entry into force.

3.3 Specific waste laws in Kazakhstan

In the previous chapter general law on waste management of Kazakhstan was already presented. In the meantime, this is the base of regulations for waste management. One of the key trends in modern development is the focus on sustainable development, which implies harmonious development in terms of environmental, social and economic components. Kazakhstan in this sense is doing its best to improve and develop its national law regarding protection of environment. Household waste management is currently one of the most pressing problems in modern cities.The main measures taken by local authorities

to address this issue should be to reduce the amount of waste to be disposed of, to recycle it and turn it into secondary raw materials. The effectiveness of these measures depends primarily on the degree of state regulation as well as the current legal framework for waste management.

In the process of analysis of municipal solid waste generation in Nur-Sultan in next chapters I was following the information presented by the Information and Analytical Centre for Environmental Protection of the Ministry of Ecology, Geology and natural resources of Kazakhstan, Information review on the results of the State Production and Consumption Waste Cadastre 2018. The State Production and Consumption Waste Cadastre is a systematized, geo-information systems-based, periodically updated and refined set of unified data on each waste disposal site (with an indication of its spatial position), as well as types of waste, its origin and physical and chemical properties (taking into account the danger to the population and the environment), component composition, quantitative and qualitative indicators, technical, hydrogeological and environmental conditions of storage and disposal.

Kazakhstan's waste management policy, as defined in the Concept of the transition of Kazakhstan to a Green Economy (hereinafter - the Concept), is aimed at introducing separate waste collection, developing the waste treatment sector with the production of recyclable products through investment, including public-private partnerships. The Concept has defined target indicators to bring the share of waste processing to 40% by 2030, 50% - to 2050. To achieve the target indicators defined in the Concept for the introduction of collection, transportation, processing, recycling and disposal of MSW, as well as for the purpose of streamlining and systematization of the secondary raw materials market, amendments have been made to the main regulatory documents governing waste management.

After a draft of the new Environmental Code was presented in the Parliament, it raised a number of discussions among members of Parliament together with representatives from business sphere, environmental experts. Special attention is brought to such a norm in the draft of the new Environmental Code as the

transition to comprehensive environmental permits for Category I facilities subject to the introduction of best available technologies (BAT).

The Environmental Code for Waste Management has also been amended, with following concepts: the concepts of "separate collection of municipal waste" and "secondary raw materials" have been introduced; requirements have been established for secondary raw materials, for the conversion of consumer waste into secondary raw materials, for separate collection and disposal of certain types of hazardous waste (electronic and electrical equipment, mercury-containing waste, batteries, accumulators), requirements for the implementation of extended producer (importer) obligations (hereinafter referred to as the "ERRR"); a ban on dumping of certain types of waste in landfills has been introduced; and the introduction of generally mandatory national standards has been envisaged. In accordance with the Methodology, local executive bodies are developing tariffs, providing for a separate tariff for each operation.

Environmental Code of Kazakhstan contains main provisions on waste management. Chapter 42 of the Code describes Environmental requirements in production and consumption waste management. Present Chapter contains:

- Production and consumption waste and its types(Article 286)
- Classification of hazardous waste (Article 287)
- General environmental requirements in production and consumption waste management (Article 288)
- Waste management program (Article 288-1)
- Hazardous waste certificate (Article 289)
- Environmental requirements in the design of waste management activities(Article 290)
- Environmental requirements for the management of certain types of waste and their life cycle processes (Article 292-1)
- Environmental requirements for hazardous waste management (Article 293)
- Environmental requirements for storage of wastes containing persistent organic pollutants (Article 293-1)

- Environmental requirements for the transport of hazardous waste (Article 294)
- Cross-border transport of waste (Article 295)
- Recording in the area of waste management (Article 296)
- Stimulation of measures for waste disposal and reduction of waste generation (Article 297)
- Conversion of consumer waste into secondary raw materials (Article 297-1)

Next part of the Code Chapter 43 contains provisions on landfilling and is called Environmental requirements for landfills and long-term waste storage facilities. It reflects following measures:

- Storage and disposal sites for waste (Article 298)
- Classes of landfill sites (Article 299)
- Environmental requirements for waste disposal sites (Article 300)
- Wastes that are not acceptable for landfills (Article 301)
- Solid and slurry industrial waste, the disposal of which is prohibited in landfills intended for municipal waste disposal (Article 302)
- General requirements for hazardous waste landfills (Article 303)
- Waste acceptance procedures (Article 304)
- Control and monitoring during the landfill operation phase (Article 305)
- Procedures for closure, recultivation and monitoring of the landfill (part of the landfill) (Article 306)

Environmental requirements for radioactive waste storage and disposal facilities are reflected in the Chapter 44 of the Environmental Code.

The chapter has following regulations: radioactive waste and its classification (Article 307), classification of storage and (or) disposal facilities for radioactive waste (Article 308), environmental requirements for storage and (or) disposal facilities of radioactive waste (Article 309).

The adoption of the new environmental code will help to reduce carbon dioxide and other harmful substances in the environment and will help prevent climate change, which goes in line with the Paris Agreement and is a pressing issue

today. The government of Kazakhstan is ready to support green energy production in the country. Following the adoption of a new Environmental Code, it is necessary to promote the Concept of transition to a Green Economy, as well as to develop not only renewable but also alternative energy, including Waste to Energy technologies, for which there is currently no regulatory framework and incentive tariffs in Kazakhstan. Therefore, there is a question of developing a new draft law to support alternative energy sources.

One of the recent decisions taken on a governmental level was regarding plastic bags that are in common use among local population, in particular it concerns food industry. Memorandum that was signed introduce a limitation on the sale of polyethylene bags in Kazakhstan. It is still early to say about total ban of plastic, but this is a first steps towards zero plastic policy.

Among other specific regulations in terms of waste management there are following legal acts:

- Order of the Minister of Health of the Republic of Kazakhstan No 187 of 23 April 2018 "On approval of the Sanitary Regulations "Sanitary and epidemiological requirements for the collection, use, application, neutralization, transportation, storage and disposal of production and consumption waste"
- Order of the Minister of Environmental Protection of the Republic of Kazakhstan N 169-p dated 31 May 2007 "On approval of the Waste Classifier"
- Order No. 244-p of the Acting Minister of Environmental Protection of the Republic of Kazakhstan dated 2 August 2007 "On approval of the list of wastes to be disposed in different classes of landfills"
- Order No. 145 of the Minister of Energy of the Republic of Kazakhstan dated 25 November 2014 "On Approval of the Model Rules for Calculating Norms of Generation and Accumulation of Municipal Waste"
- Order of the Minister of Energy of the Republic of Kazakhstan No 404 dated 1 September 2016 "On approval of the methodology for calculating the tariff for collection, removal, recycling, processing and disposal of solid domestic waste"

- Order of the Minister of Environmental Protection of the Republic of Kazakhstan dated 16 April 2012 No 110-ө "On Approval of the Methodology for Determining Environmental Emissions Standards"
- Order No. 229 of the Minister of Energy of the Republic of Kazakhstan dated 20 March 2015 "On approval of the Rules for Management of Mismanaged Hazardous Wastes Recognized by Court Decision as Acquired by the Republican Ownership"
- "Sanitary Regulations for the Construction and Maintenance of Solid Waste Landfills" No 3.01.016.97 (approved by the Chief State Sanitary Doctor of the Republic of Kazakhstan on 29 April 1997).

All these standards are aimed at solving the problems of resource saving through the effective involvement of waste in industrial turnover, the use of modern methods and tools of standardization and metrology, which are necessary for the regulation of this activity, including the use of such tools as passporting, registration, certification, licensing, as well as identification, coding, classification, information support, identification of hazardous and commercial (inert) characteristics of waste. This problem can only be solved if the entire regulatory framework for waste management is continuously developed.

4. Management of Municipal Solid Waste MSW in Austria

Austria as a part of European Union follows the regulation of the EU. For the start of the analysis of municipal solid waste generation it is necessary to get an overview of principles and strategies that Austria implemented as a legal basis in waste management. In this chapter I am going to make a brief overview of legal acts of Austria on the topic of waste management, more detailed analysis of it will be in the next following subparagraphs. The main legal document on the European Union level is the Directive No 2008/98/EC (Waste Framework Directive) which contains main principles of waste management as waste prevention, re-use and recycling as top priorities. These are the principles that became key ones not only in developed European countries but also in developing countries and transitional economies including Kazakhstan. Without

this effective approach in the policy of waste generation there is no economic efficiency, it also leads to more environmental problems that could cause international crises.In order to avoid such issues, waste avoidance, recovery, removal were implemented as waste management main principles in Austrian law. In order to follow the principles stated in the Directive and implement them into Austrian waste management law in 2002 Waste Management Act (WMA) was adopted. The Federal Waste Management Plan (FWMP) that was adopted in 2011 serves to support achievement of the objectives and principles of Waste Management Act (WMA) of 2002. This is a comprehensive document that contains general information on waste generation in Austria, along with separate detailed analysis on different type of waste generated within the country together with a statistical data provided in a FWMP.

When it comes to sources where information is subtracted from, they are diversified, including Federal Government, Provincial Government, individual associations focused on waste management, as well as expert studies. With analysis of different sources, FWMP could give more precise and accurate data on waste generation not only based on governmental structures and administration but also on results brought up by independent individual experts and specialized companies.

The Federal Waste Management Plan of 2011 describes in a comprehensive manner amount of waste that was generated across the country. There are accurate numbers of each type of waste produced in Austria that was recorded in accordance with catalogue system (Abfallkatalog in Germ.) ÖNORM S 2100. The trend of waste generation in 2011 showed the biggest share of excavated materials 45% in total, on the second place were other type of waste with 17,5%, on the third place there was construction waste that contained 12,7 % . In the document there is not only the statistics provided but also analysis and explanations given of the processes that led to the amount of waste in 2011. In accordance with the FWMP the largest part of the waste was reprocessed and recovered – 63%.

Based on provided facts and figures, also economic state and processes in the country Federal Ministry of Agriculture, Forestry, Environment and Water Management of Austria provided a forecast for the future waste streams as a part of the research. The forecast let government to make decisions regarding constructions of new disposal plants, approximate figures of waste that could be generated in next 5 years, upgrading the rules both on national and international levels. Forecasting is a complex process that requires following institutions to get involved in such as of the Austrian Institute of Economic Research (WIFO), the Federal Ministry of Finance, the Institute of Advanced Studies in Vienna (IHS), the International Monetary Fund (IMF), Bank Austria (BA), the Organization for Economic Co-operation and Development (OECD). Comparative analysis within 10 years is a part of the Plan that was done to see the progress and effectiveness from technologies and system implemented. Assumptions given in the Plan of 2011 based on economic and population growth rates of Austria. This approach helps to implement preventive measures in waste management of the country. Sustain economic growth of Austria and other developed countries of the world provides more chances to develop modern green technologies, including solution of waste management issues. Considering the fact that is an important factor of switching to a new technological level of sustainable development and ecological ,countries with a significant experience in green technologies and international companies are aiming to reduce costs for green projects to make them more affordable.

Based on the data provided on each waste stream at 2011 and predicted future waste stream helps to see the whole picture clearly, with focus on every waste stream that has been generated within certain amount of time. This individualistic approach helps to find better solution when it comes to treatment of each waste stream. Moreover analysis of each waste stream helps to realize weak spots where governmental institutions need to put more attention to. Categorizing different types of waste and measuring it is also useful for planning how much of waste should undergo processes of sorting, reprocessing, physico-chemical and biotechnological treatments, incineration, landfilling and others.

According to the Federal Waste Management Plan of 2011 most of the waste was reprocessed in accordance with its type. Types of waste that undergoes treatment through landfilling are ash, slag and dust, recoverable materials from trade and industry, some parts of construction waste, electrical and electronic equipment waste, residual waste resulting from regeneration of bulky waste from households. In comparison with waste treatment in Kazakhstan the percentage of waste that goes to a landfill is significantly higher, which is around 90%. By the beginning of 2019 around 100 mln tonnes are landfilled in Kazakhstan ("100 Million Tonnes of Waste Accumulated at Landfills in Kazakhstan - Kazakhstan and World News for Today" 2019), and only 10% of waste in the country undergoes recycling. There are several reasons for that, including issues with separation, lack of waste facilities in cities, not enough recycling plants, also geographic factor plays a role that influence people's attitude towards landfilling.

In the Federal Waste Management Plan 2011 and 2017 if to consider municipal solid waste generated in Austria it was subdivided to different streams. There is a general term of that type of waste presented as "waste from households and similar establishments". In line with definition of "waste from households and similar establishment" FWMP 2011 it contains following categories such as residual waste, bulky waste, recoverables (paper, glass, metal,plastic, textiles, etc.), biogenic waste, and hazardous household waste and waste electrical and electronic equipment. When it comes to waste streams coming from households, they are grouped on a mixed municipal waste from households, bulky waste from households and similar establishments, separately collected hazardous household waste, separately collected recoverables from households and similar establishments, separately collected biogenic waste from households and similar establishments, home and community composting in home gardens, also there is a category of other waste from residential areas.

For the further analysis that was made in 2011 presented by the Federal Minister of Agriculture, Forestry, Environment and Water Management they brought up one of the biggest federal land as a case study to show how many waste was generated in details. The analysis showed that there is a constant increase of waste coming from households, for example there was an increase of packaging

and metal waste, as well as glass waste, lightweight fractions. All this calculations could be done due to the separate collection that is been successfully implemented in the country a long time ago.

In the list of household waste being collected by the austrian companies following constituents could be found: biogenic waste (26,7%), paper, cardboard and cardboard packaging (21,8%), lightweight fraction (11,5%), glass (7%), wooden packaging and bulky wood (6,7%), metal packaging and bulky metals (4,1%), residual fractions have 9,7% in overall amount of Waste from households and similar establishments that has been collected in 2009 according to the FWMP 2011. Among other fractions of waste (12,5% in total) coming from households there were Inert materials, Sanitary articles, Textiles, Waste electrical and electronic equipment, Hazardous household waste, Mattresses and carpets, Other recoverables. The overall amount of municipal waste generated in 2009 was 3,895,000 tones, among which residual waste presented the biggest share of 1,402,100 tonnes which is 36% from the total number. Packaging still takes a second place in the list with the sum of 1 250 500 tones. The most popular type of packaging is paper packaging, then goes glass packaging, less amount of metal and lightweight fraction packaging was collected from households in Austria in 2009. Main characteristics of such waste is that quantity of it is much more higher than its bulky density. The reason of it lays in the increased residential population, individual (single) households, as well as increased demand on take away food and beverages from restaurants and cafes. Some restaurants have plastic take away packages. What makes a problem for further collection and processing is that they are colored, not transparent. This leads to a question whether there are restrictions to throw away colored plastics to the same trash bin with transparent plastic bottles and if there is a technology to recover both types of plastics. To my personal view it is also important to illustrate on waste collection bins with stickers that shows which type of plastics should be thrown away in order to simplify the process of separation on a first stage. Certainly, there is a human factor that we also have to consider, therefore technologies that are in place play a huge role in a waste management.

Within the period of 4 years increased for around 2,4 %(“Population of Austria” 2020). This led to a raise for c.a. 6,3 % in the amount of municipal waste generated. According to the FWMP 2016 in 2015 the overall number of waste reached 4,160,000 tonnes of municipal waste from households and similar establishments. In Vienna since 2009 amount of residual waste that is normally generated by households and similar establishments, which in the FWMP 2017 is defined as a mixed municipal waste increased from 515,931 to 523,545 tonnes per year. This number did not change dramatically, due to the system of separated waste collection as paper, plastic, metal, glass, another reason could be slight increase of population of Vienna. On the other hand significant components of residual waste are “plastics and composite materials”, “sanitary articles”, “textiles”, “glass”, “metal”, “wood”, and “hazardous household waste”. Due to the different types of waste that residual waste contains types of treatment also differentiates. There are three main types of treatment when it comes to residual waste (mixed municipal waste) in Austria. If to analyze last two Federal Waste Management Acts of 2011 and 2017 significant part of mixed municipal waste in 2009 and 2015 went through thermal treatment, in average 75%.

In 2009 overall amount of residual waste in Austria reached a number of 1,402,100 tones, in 6 years the ratio increased by 29,500 kg, which is not a big number. Second part of the mixed municipal waste went through biotechnological treatment which was 341.400 tones or 24,4% out of the 1,402,100 tones. Due to the efficient technologies operated in Austria there is a separation process that allows to recycle certain amount of mixed waste generated by households. In 2009 from overall amount around 5,1% of the mixed municipal waste went through recycling process. In comparison with 2009 the rate of recycled waste from overall amount of residual waste dropped in 2015 from 5,1% to 0,97% and amounted to 13,900 tones only.

Bulky waste is another type of municipal solid waste collected separately in every Federal Province of Austria. It mainly consists of such material groups as metal and wood. In Vienna in 2009 the amount of bulky waste composed 25,000 tones, which is 9,7% out of the overall amount of bulky waste collected in Austria. In 2015 statistics shows the number of 244,200 tons of bulky waste being collected

in the country, including all 9 federal provinces, from this we could observe a slight decrease of the rate. Vienna showed the number of 27000 tons of bulky waste being collected in 2015, and it represents 11% of the overall amount. If to compare with data from 2009 we could observe the rise of bulky waste rate to 1,7% in Vienna.

However, considering the prognosis of the data on waste streams of 2016 provided in the Federal Waste Management Act 2011 the overall number of 267,000 tonnes of bulky waste was expected to be generated in Austria, the forecasted figure exceeded the real one by 8,5%. Since 2006 the average rate of bulky waste in Vienna had never been less than 240,000 tones.

Expected treatment of bulky waste that was given in 2009 which are following: recovery of sorted recoverables from processing, thermal treatment for recovery of the energy value, landfilling of residual waste resulting from regeneration. Providing estimations give a chance for recycling companies, governmental institutions and other parties involved to make appropriate decisions, adapt and optimize the recycling plants for the amount of waste that needs to be processed. The estimations that are provided in the FWMAs are based on the production statistics, annual statistics on tourism, data from the operators of waste management facilities, recycling companies, Statistics Austria of population and housing developments, also taking into account assessable change in selected waste streams taking waste management developments and measures into account. When it comes to estimations there are always risks that are difficult to predict. Especially such things like political decisions that influence on the migration rate, business development. These processes influence the rate of generated waste in the country.

Hazardous household waste is the other type of the waste coming from private households, and from the waste generators that have the same characteristics of household hazardous waste. The main characteristic of being related to the group of hazardous household waste is being collected by waste generator. In the FWMP of 2016 there was a separated data illustrating specific types of hazardous household waste that was collected in Austria. According to the statistics of 2009

there is only a description of the hazardous household waste and the overall volume of it. Whereas in the FWMP 2016 there is a specific statistics of the waste collected from households in Austria that has hazardous characteristics. The data shows how much of that type of waste was generated in categories. The biggest share of 27% of the hazardous household waste was related to old paints, varnishes and solvents. Another biggest share of 23% of the waste responds to the waste oils, oil mixtures and oil-contaminated equipment. Batteries and accumulators are on the third place on the list with 19%. Chemical residues are presented in the list with 10%.Asbestos cement and asbestos waste and other types of the waste are presented with 9% and 12% respectively.

In Vienna the number of hazardous household waste in 2009 reached 1,900 tonnes, the rate of it decreased for 440 kg in comparison with the same category of waste in 2016. Regarding treatment of that type of waste there are two options such as physico-chemical treatment or thermal treatment, that hazardous waste generated by households is undergoing after presorting. Since this is a hazardous type of waste some companies, pharmaceutical ones for instance, they accept it in their stores. As an example, in Vienna some big grocery chains allow to have a small stationary collecting points for batteries.

Another category of the waste being generated by households that undergoes treatment is separately collected recoverables from households and similar establishments. They contain following type of waste such as paper, glass, metal packaging, textiles, wood etc.In 2015 around 1.,45 million tonnes of separately collected recoverables was gathered, which presented almost one third of the whole amount of waste from households. In 2009 statistics shows us that 1,386 million tonnes of separately collected recoverables were collected in Austria, which also constitutes 1/3 of the recoverables that were collected separately by the households or similar establishments.

4.1. Management of Municipal Solid Waste in Kazakhstan

The main document regulating the sphere of MSW management in the Republic of Kazakhstan is the Environmental Code of the Republic of Kazakhstan. The Code's requirements for waste management can be conventionally divided into three parts: the environmental requirements for individuals and legal entities, in the course of whose activities wastes are generated, to be fulfilled before waste generation.

Environmental requirements for individuals and legal entities, in the process of activity of which wastes are formed, to be fulfilled after the formation of wastes and include requirements for waste accumulation, as well as collection, processing, utilization, neutralization, transportation and storage (storage) of wastes. Environmental requirements for natural and legal persons, in the process of activity of which wastes are generated, to be fulfilled at waste disposal and include requirements for waste disposal sites, including hazardous waste disposal sites, as well as radioactive waste disposal sites.

In the Environmental Code definition of following notions of waste management are given: secondary raw materials, disposal of waste, recycling, non-hazardous waste, hazardous waste,municipal solid waste, separate collection of municipal waste. In accordance with the Code, wastes are products formed as by-products, useless or undesirable as a result of industrial and non-productive human activities and which are to be recycled, processed or buried. In order to collect and process waste classification of waste has to be defined, therefore it is also provided in the Code. There are two types of waste defined in the core legal environmental act of Kazakhstan that are given, they are industrial waste and consumer waste products.

There is also categorization of waste by aggregation and physical condition, by origin, classification according to the degree of danger of environmental impact divided by 5 classes, and the classification of wastes both by origin and hazard level. Cconsidering that our focus is primarily on municipal solid waste, we should look at the definition of municipal solid waste provided in the Code. Residential

and administrative buildings, educational institutions and shopping centres, airports and bus stations generate hazardous waste of types 4 and 5 which are defined as municipal solid waste. So, more precisely municipal solid waste comprises following objects or substances like unsuitable food products, household items or goods that have lost their consumer properties.
One of the challenges of current waste management system not only in Nur-Sultan but in the entire country is collection and recycling. The country have started to implement new technologies of recycling and separation of waste recently in line with a process of developing green economy.

Landfilling has been the way of dealing with almost all types of waste in the country for a long time. Which negatively affected ecological situation of the country, with CO2, NH4 and other harmful gaseous emissions. To date, dumping waste in landfills is the main method of permanent waste disposal in Kazakhstan. Most solid domestic waste is not sorted for reuse/recycling and is dumped at landfills. Waste disposal facilities are often difficult to call landfills, as they are essentially unauthorized landfills. Most of them are not engineering structures, which can be categorized as municipal solid waste intended for landfilling. Also, waste is often disposed together with hazardous medical and industrial waste that contains heavy metals.

Adoption of a new Environmental Code is aimed to change current situation dramatically, due to the formulation of principles of state policy on waste management, including the new "extended producer responsibility". This principle establishes the responsibility of product manufacturers to ensure the proper management of the waste generated by the production of such products throughout the life cycle of the waste, from its generation to its recovery and/or disposal. In addition, the Ministry of Energy of the Republic of Kazakhstan in cooperation with Joint Stock Company "National Company "Kazakhstan Garysh Sapary" in order to prevent the formation of unauthorized dumps are providing space-based monitoring of waste disposal sites. According to the data of the Geoportal of the Ministry of Energy of the Republic of Kazakhstan, by the start of 2019, the territorial departments of ecology have carried out visits to 3,758

objects, of which as of today: 967 unauthorized objects have been disposed of, and 2,700 objects have been sent to local municipal authorities for disposal.

If we consider available data from 2017, we could see that about 345,438 tn of municipal solid waste (MSW) are generated per year in Nur-Sultan and the recycling rate was 9% (Ministry of Environment Geology and Natural Resources of Kazakhstan n.d.). According to statistical data, waste generation rates are 364 kg/inh./year or 0.97 kg/inh/day. Referring to statistical data (Table 4.1) reflecting data from 2017 and 2018, the MSW generation is between 0.97-0,81 kg/inh/day, with a decline trend (Ministry of Environment Geology and Natural Resources of Kazakhstan n.d). Herewith we could outline that measures taken like installation of containers for waste separation and further processing of a separated waste brought its results in decrease of waste generation rate.

Table 4.1 Waste generation in Nur-Sultan in 2017 and 2018
Source: (Ministry of Environment Geology and Natural Resources of Kazakhstan n.d.)

Year	Waste generation (municipal solid waste, tonnes)	Population	Waste generation (kg/inh./day)	Recycled waste (%)
2017	345,438	972 672	0,97	9%
2018	307,626	1 032 475	0,81	11,5%

From the table above we could see decreasing tendency of waste generated in Nur-Sultan within 2 years from 2017 - 2018, while population rate increased. The reasons for a waste generation rate being reduced by more than 10% in one year are installations of containers for separate collection and increased recycling rate by 2.5% from 9% to 11,5%.Due to a low rate of separation of waste, recycling rate is not exceeding 11% since 2018. However it is worth to note changes happened in 2017, when 686 mesh containers were installed for separate collection of plastic waste, 670 containers for collection of waste mercury-

containing lamps, 300 containers for collection of ash and slag waste from private households.

In the capital of Kazakhstan, the waste processing complex of Kaz Recycle Service LLP is functioning, along with another big company dealing with waste collection and reprocessing Clean City. Clean City NC LLP is the largest company in Nur-Sultan, specializing in the removal of solid domestic waste (MSW), which has established itself in the market as a company with a modern material and technical base and a staff of qualified employees, with its own fleet of specialized equipment, which provides high quality services. Clean City NC LLP has a modern park of garbage trucks, which consists of 66 specialized machines (30 units of which are produced in 2017) of "Euro-4" ecological class. The Company purchased small-size garbage trucks that allow removal of solid waste from densely built-up areas. 10 years ago in the country there was no such kind of companies, that provided high quality of service of waste collection in the city but today we already could see the progress in this area of economic development. In order to fulfill their tasks, there is obligatory procedure of concluding an agreement between so-called flat-owner cooperative and waste collection company. Even with the latest municipal solid waste collection technologies in place, difficulties arise during the household waste collection phase. People are not used to collect garbage separately, using the old way of disposal, throwing it all away together. However, there are households that separate waste before its disposal, which helps further processes of recycling and landfilling.

If to describe the process of recycling at the Clean City NC LLP in Nur-Sultan. The plant of Clean City NC LLP deals not only with sorting, but also processing. There is a special team that delivers around a thousand tonnes of solid waste (MSW) within 24 hours only. All waste is sorted and one part of it remains as recycled material. Only 12% of all waste is sorted and recycled at the plant, because the rest of the waste delivered to the plant as not separated. The remaining 88% go to landfill. Recently we could see progress in recycling of municipal solid waste in the capital of Kazakhstan.

At the plant there is a Zone A. Collected amount of waste is being brought into this area. It consists of two parts: one part is separate collection, which unfortunately is on an early developing stage in Nur-Sultan; the other part is mixed waste. But even though the residents of the city still do not take the separation of rubbish seriously enough, the workers of the plant are trying to at least sort it out to a certain extent. For example, there are white cars at the landfill - this is the transport of rubbish collection companies, which bring “dry” rubbish instead of "dumping" it in the landfill. There are two lines in the sorting system: one line carries all mixed waste and the other line carries separated rubbish.

Primary sorting is a next step of waste processing. In the primary sorting area, everything is done manually. If electronic and electrical household appliances were additionally selected in Zone A, then glass, plastic bags and cardboard are selected. At the plant, this is called "large-scale" type of waste.

After the initial sorting process, all this is fed to the drum. The drum is a huge piece of equipment with 80 millimetre diameter cells. Through these cells, sand, small rocks and leaves are poured out into large boxes. To put it in another way, all the small pieces of waste are disposed of here. Next, they go along the line into the big trucks. At the plant, this is called 'dry fine organics', which also goes to the landfill.

Secondary sorting. At this stage waste is now becoming recycled and has commercial value. In the second stage, everything is sorted: PET bottles, various types of plastic, including plastic packaging, polyethylene bags. These types of recyclable waste are distributed in different sorting baskets. Afterwards baskets which is filled faster, is sent to the machine that squeezes garbage to the form of briquettes (each weighing a ton). Some parts are sold, while others are sent to further processing.

Next stage of waste processing includes work of a department dealing with technical type of waste, such as mercury lamps and coloured cables. Specialists of technical department disassemble waste into small pieces, preparing those particles for sale as recycled materials.

The waste recycling plant also have production department where all types of plastic are recycled: high-pressure plastic (HPV) and low-pressure plastic (LDPE), PET bottles, polyethylene bottles. The capacity of the production department is still small, so anything that the plant cannot and does not process goes for sale. It is not a secret that when waste is recycled, the cost of raw materials becomes a lot more expensive.

Floatation. Among other things, all material is floated, i.e. washed. This process is now in place in the factory thanks to the company itself. Before Kaz Recycle Service LLP came, it was not here. Now all the products that are delivered to the plant are being going through floatation.

Ecowoll. Some paper and cardboard waste is recycled into equivalents. The paper is dried, crushed into flour, mixed with boric acid and sodium tetraborate, and ground again. As a final product glass wool is produced from materials mentioned above.

Taking into account that waste generation will tend to grow, in order to increase recycling capacity of the waste, Senate (Upper House of the Parliament) deputies are considering a bill "On amendments and additions to some legislative acts of the Republic of Kazakhstan on energy waste management, water protection strips and transportation of goods by rail" and recently held a Parliamentary session where they decided to return it to the Majilis (Lower House of the Parliament) for revision. The bill proposes to generate electricity from incineration, thus reducing the amount of waste to be disposed.

After waste generated in the city of Nur-Sultan being collected significant part of it goes to landfill. The landfill consists of several cells and one of them is completely overflowing. The designed capacity of the cell is 2,800,000 tonnes, but there are almost 4 million tonnes of waste. This cell has been filled in for eight years. Now it is already covered with sand, and there is a time of recultivation, that is after time it will be covered again. In 25 years' time, when everything decomposes, composts, biomaterial will come out of it. And then it will be possible

to plant plants, trees and greens in the area. Cells were built on the basis of Spanish technology. Pits were dug first. The earth was lined with a geomembrane to preserve groundwater. This is very important because when groundwater filtrate is reached, there is a risk of water pollution, including flowing water. After the geomembrane, all drainage pipes have been laid to collect filtrate and gas. The geomembrane and crushed stone are then laid down again. All this technology consists of eight layers.

Two large reservoirs are provided for this technology to function. They collect filtrate, dark slurry. The filtrate is poured over the pipe from the first cell, as no filtrate has yet formed in the second cell. This liquid is pumped to a chemical and physical treatment station, where it is brought to the treated water (technical water condition). This service water fills the second reservoir from which the liquid is pumped out by water trucks and irrigates the entire area and all cells to avoid fire. This is one of the most important safety points.

On the example of the plant located in Nur-Sultan, I would like to give the pros and cons of its development. The positive aspects include the fact that the work of this plant marked the beginning of waste recycling phase in the city, as well as the application of new technologies including Spanish, Finnish, Austrian and Italian ones.

Among the acute problems at this stage of the waste processing plant's development are attracting investments to further modernization of technologies, introducing the latest technologies and increasing tariffs for waste processing, recycling efficiency needs to be raised from 12 to 75%. Furthermore increase of wages for employees and ensuring social security should be a priority.

In order to decrease the amount of waste generated in the city experimental studies on waste generation in Nur-Sultan were performed in 2012 (Ministry of Regional Development, 2012). Based on the results, new norm on the waste generation was established by the Nur-Sultan city governor's office (Maslikhat of Nur-Sultan):

- 2.16 m^3/inh/year for people living in apartment houses
- 2.33 m^3/inh/year for people living in private houses.

The experimental measurements were made by calculating the volume and weight of waste with special containers and waste collection cars. The data on mass and volume of waste were tracked on a daily basis and the data were used to determine the average weekly, monthly and seasonal norms. The density of the waste was 157 kg/m^3.

Based on these data the waste generation was 353 kg/per capita/year or 0.968 kg/per capita/day (Rojas-Solórzano, Inglezakis, and Ismailova 2014). This new approach has not been effective in decreasing waste disposal rate from households, according to statistics we could observe only raising trend of waste disposal from that moment on. Particularly, considering outskistrts in big cities like Nur-Sultan or Almaty, people do not have facilities to do separation of waste from households and dispose it accordingly. At those areas where population do not have access to MSW collection services, 97% of MSW is taken to uncontrolled dumps and substandard authorized landfills without processing or recycling(Rojas-Solórzano, Inglezakis, and Ismailova 2014).

As is evident, a fluctuation of waste generation and a difference between the statistical data (based on waste collected) and actual data (based on waste generated, experimentally measured) is observable. It was explained by such factors as lack of weighing equipment for landfill of municipal solid waste that appeared as a reason for fluctuating data and low collection rates by organized systems, which resulted in waste disposal at illegal dumps and does not allow for consideration of waste generated (Rojas-Solórzano, Inglezakis, and Ismailova 2014). Nonetheless, the trend in Nur-Sultan is the opposite, i.e. actual data are lower than statistical data. Furthermore, the collection rate in Nur-Sultan is high enough, estimated between 72-90%. A possible reason for statistical data showing different rates is that population number was underestimated, therefore collection rates appeared higher. The booming construction activity in the capital brings in a growing number of workers who generate waste but are not officially

registered at municipality of Nur-Sultan. If this trend will remain the same, considering increasing demand for housing among the local population, as well as the process of urbanization, statistics of waste collection will become even more complicated. It will require more precise and reliable data to provide overall picture of waste generated on a local scale. This is essential information that is necessary to imply for developing the entire waste management system of the city. Moreover, statistical data are based on Municipal Solid Waste which possibly contains big amount of other type of solid waste such as construction and other commercial waste, however the norms are based on household solid waste specifically. The differences between MSW and household waste could be significant, as an example 1.04 and 0.88 kg/inh/day in Korea (Zhang et al., 2010). Therefore, the rate 1.39 kg/inh/day is used in the DSS tool.

Setting norms of municipal solid waste per capita could be considered as one effective methods that is intended to decrease amount of waste generated in the cities.

The composition of municipal solid waste in Nur-Sultan municipal solid waste composition differs depending on weather conditions and season. In the autumn amount of food waste increases rapidly that is associated with the use of a population of more fruits and vegetables, but in the summer and spring the number of small dropouts (street debris) grows. The composition of MSW also has changed significantly over the time. So, the proportion of plastic materials and paper has increased recently, whereas coal and slag has almost disappeared (after the transition to centralized heating).

As expected the composition of packaging waste differs by region and in absence of local data the average of MSW is used in DSS tool, Decision Support Software. It is a computer integrated tool, aiming at supporting the decision maker throughout the various steps of waste management planning and allows a thorough understanding of the complex interplay between the numerous factors involved in integrated waste management (Bani et al., 2009). Based on the preceding analysis, the data for the Composition panel of DSS are as in Table 4.2.

Table 4.2. Input data regarding waste composition for Nur-Sultan (Source: Rojas-Solórzano, Inglezakis, and Ismailova 2014)

	Type	Composition (%)
1	Organics	28
2	Garden	1,5
3	Paper/cardboard (packaging)	8,4
4	Paper/cardboard (other)	4,6
5	Wood (packaging)	0
6	Wood (other)	0
7	Glass (packaging)	5,2
8	Glass (other)	9,3
9	Metal (packaging)	0,9
10	Metal (other)	0
11	Plastic (packaging)	8,6
12	Plastic (other)	9,9
13	Other	23,6

Collected waste is processed in the MBT plant or is directed to the landfill. The waste processing complex LLP «Altyn-TET» started its operation in the end of 2012 in Nur-Sultan (Rojas-Solórzano, Inglezakis, and Ismailova 2014). Based on the analysis above, the data in Table 4.3 are used in the DSS tool.

Table 4.3 Decision Support Software input data (Source: Rojas-Solórzano, Inglezakis, and Ismailova 2014)

Parameter	Value
Waste generation per capita (kg/inh/day)	1,39
Annual waste generation growth (%)	3,33
Equivalent population	742,900
Population reference year	2012
Planning period (years)	20
Plastics price (€/tn)	236
Ferrous metals price (€/tn)	89
Aluminum (€/tn)	360
Glass (€/tn)	20
Paper (€/tn)	12
Electricity (€/kWh)	51
MBT capacity (early 2014, tn/y)	124,100

Furthermore, I would like to consider typical type of waste that is collected in Vienna in order to identify differences and similarities between waste containment of capitals of Kazakhstan and Austria. Data for the table below represents type and composition of municipal waste in Vienna in 2015.

Table 4.4 Type and composition of municipal solid waste generated in Vienna 2015 (Source: “Federal Waste Management Plan of Austria” 2017)

	Type	Composition %
1.	Mixed municipal waste	59%
2.	Bulky waste	3%
3.	Hazardous household waste and batteries	0,16%
4.	Waste electrical and electronic equipment	1,4%
5.	Paper, printed matter and packaging	14%
6.	Glass packaging	3,3%
7.	Metal packaging	0,3%
8.	Bulky metals	1,4%
9.	Textiles	0,5%
10.	Plastic packaging	0,8%
11.	Bulky wood and packaging	5%
12.	Other recoverables	0,3%
13.	Biogenic waste	11%

From the table of composition of municipal solid waste collected in Vienna we could see that mixed municipal waste has the biggest share of 59 % among other thirteen types. According to the Federal Waste Management plan of Austria "mixed municipal waste" is a waste that forms mainly from private households or which is similar to domestic waste by its nature and composition. Composition of the mixed municipal solid waste include following fractions as plastics packaging, preventable/partly preventable food waste, textiles, footwear, glass, metal packaging. Next biggest share of municipal solid waste is paper, printed matter and packaging with 14%. Biogenic waste comes next with 11%. The other fractions show less than 5%, among which are bulky wood and packaging, glass packaging, bulky waste, waste electrical and electronic equipment. The last in the list is hazardous household waste and batteries with 0,16%.

Composition of municipal waste collected in Nur-Sultan in 2015 shows us the organics is the dominant type together with other type of waste with rates of 28%

and 23,6% respectively. Packaging is represented with paper, glass, plastic, metal, among which plastic type is more common with almost 10%. Noteworthy that metal and wood as separate components was not collected at all. Plastic packaging in Nur-Sultan is represented in higher amount than in Vienna, whereas in the capital of Austria glass and paper packaging hold leading positions among other materials. Knowing this fact and considering that plastic packages are mostly going to landfilling there is a need to reduce usage of those

From the findings on waste management system of Kazakhstan we could see that the law is in place that is regulating this field. However, it is not a secret that there are issues which have to be solved in order to develop an efficient WM to reach high standards of OECD countries.

Key problems of the WM system in Kazakhstan comprise following:

- Public access to collection and disposal services is only acceptable in large cities
- Small towns as well as rural areas are characterized by a lack of or insufficient provision of these services and poor quality of services.
- Absence of a system for sorting municipal solid waste involving the public, as well as specialized sites and the remoteness of landfills result in an increase in unauthorized landfills
- Insufficient fenced container yards, as well as container wear and tear, create an unsanitary environment around multi-storey buildings.

In this regards it is worth to note that measures that are outlined in the Concept of transition to a Green Economy are designed to address those issues. Measures are designed to bring more responsibilities to the producer, facilitate decrease of generated amount of waste, lower the greenhouse gas emissions to the atmosphere. Dealing with the problems of waste management should be prioritized, because it directly affects health of population of a country, especially nowadays in times of pandemics. In times of world crisis caused by COVID-19, people's health and life are heavily damaged and depend on the decisions made by government in this regard the quality of life will either improve or deteriorate.

One of the important tool that exist on the EU level it is the Environmental Implementation Review organized by the European Commission. Such a tool that can be implemented in the regulation system of Kazakhstan's waste management. This controlling mechanism could be helpful in order to structure the results of implementation of law and identify problems on an intermediate stage.

In regards to challenges in waste management in Austria reduction of gas emissions remains one of the current goals in Austrian waste management. Diesel cars that are used in the urban areas are one of the biggest emitters of nitrogen dioxide. Reduction of usage of those type of machines could help to lower release of gases like NH_3 to the atmosphere. However, there are some obstacles for companies in agriculture sector to change from diesel engines to the other fuel, e.g. higher costs of the petroleum in comparison with diesel. Therefore, it could take some time to switch to another type of fuel. To make a comparison of municipal solid waste generation and recycling rates in Austria and Kazakhstan we could observe results of 2018 of both countries.

Table 4.5 Amount of generated Municipal Solid Waste in Kazakhstan and Austria in 2018 (Sources: Data from "Daily MSW Generation per Capita by Select Country" n.d.; INFORM.KZ 2019)

Country	Year	Waste generation (municipal solid waste,million tons)	Population (mln)	Waste generation (kg/inh./year)	Recycled waste %
Kazakhstan	2018	4, 32	18,3	236,3	11,5%
Austria	2018	4,27	8,8	485	57,7%

As we can see from the table above there is a big gap between countries when it comes to population rate. Kazakhstan's population density in 2018 was rated with 18 people per m^2. In 2018 Austria population density was 107 people per m2. Such factor as enormous territory of 2 724 902 км² has been influencing whole approach towards the issue with waste generation. Practically a big space of unused land stimulated the process of uncontrolled landfilling in Kazakhstan. With the same amount of waste generated during the year, recycling rates in Austria are almost 9 times higher. This is a good example of how waste processing companies should work effectively.

Having the same amount of municipal solid waste generated during the year, recycling rates in Austria are almost 9 times higher. This can be a good example for countries who are on the early stage of waste management development of how waste treatment plants should work efficiently.

4.2. Comparison of MSW management in Austria and Kazakhstan

First thing to say about differences in waste management between Kazakhstan and Austria, systems of both countries are on different stage of development. It is related to a fact that Austria has been developing its waste management for more than 15 years. In Kazakhstan this topic has started its development quite recently.

To compare Austrian and Kazakhstan waste management, in the first place there are differences in terms of territory, population, GDP, legislation system. Kazakhstan is a country with territory 32 times bigger than Austria, however in Kazakhstan population rate is only 2 times bigger than in Austria. Population density of Austria is 15 times higher. In terms of GDP, Central European country is showing higher rates than Kazakhstan.

Austrian waste legislation is primarily based on the acts issued by the European Union, whereas for Kazakhstan implementation of new documents on waste

management depends on international agreements that country joins and ratifies. For Kazakhstan there is no certain separate document dedicated to implementation of waste management regulations as Austrian government has. However, there is the National Report on the state of the environment and the use of natural resources, that government of Kazakhstan issues annually. I believe that an advantage of this approach is having systematic collection of updated information focused on current state of waste management, it also helps to analyze data, plan, foresee processes as waste generation, collection, processing, landfilling and waste treatment.

In Kazakhstan in 2018 736 companies were dealing with collection of non-hazardous waste. Nur-Sultan has 142 companies registered as municipal solid waste collection, recycling and disposal companies (LLP Research Group DAMU RG 2018). Considering statistics of last 5 years, figures of above mentioned companies showed only increasing trend. Along with it, recycling rates have been rising as well, but not exceeded 13%. If to refer to the Federal Waste Management Plan 2017 in Austria 11 thermal treatment plants for municipal waste are in operation. In 2015, around half of the approximately 4,160,000 tonnes of municipal waste from households and similar establishments was supplied for material recovery ("Federal Waste Management Plan 2017 Part 1" 2017). More than 40 % underwent thermal treatment, while less than 10 % underwent mechanical-biological treatment (FWMP 2017 page 45).

One of the differences is a budget cut of waste management of two countries. Assumption can be made that Austria is investing a lot more in waste management. In Kazakhstan it is planned to revise the budget for the development of waste management with implementation of best practices. OECD provides support for the development of budget projects and introduction of new technologies ("GREEN Action Task Force: Greening the Economy in Eastern Europe, Caucasus and Central Asia - OECD").

Considering similarities that both countries share, I would like to mention dedication to development of green economy and sustainable development. What Kazakhstan could implement from Austrian best practices is technologies

of construction new landfills, waste treatment plants based on waste-to-energy principle. At present, Kazakhstan is actively studying the possibilities of introducing waste-to-energy principle, as well as development of concept of smart consumption. Policy on plastic packaging implemented in Austria aiming at “zero plastic”, should be a priority in long run. The ban on plastic bags has been in effect in Austria since 01.01.2020. Retailers can still issue plastic bags to customers until June 15, 2020. As of March 15th, 2020, manufacturers will be banned from importing and selling all plastic bags that are falling under the law. Furthermore, retailers have to report the correct amount of all plastic bags delivered to Austria in 2019. Switching to reusable bags made from other materials will change Austrian trade (“Ban on Plastic Bags in Austria: What Has Changed?” 2020).

In 2019 the ban was adopted by the lower house of the Austrian Parliament with a transition period until the end of 2020, during which existing bag inventories can be sold. On the EU level in 2018 amendments were outlined in the Directive (EU) 2018/852 of the European Parliament and of the Council of 30 May 2018 amending Directive 94/62/EC on packaging and packaging waste (European Parliament, Council 2018).

The distribution of reusable fabric bags is one of the initiatives that Austrian society has actively implemented in their household. This practice is one of that citizens can adopt in their households in Kazakhstan as well. Replacement single use packages with reusable packaging is a one of the goals in the waste management policy in the European Union. This policy includes encouraging the increase in the share of reusable packaging placed on the market and the reuse of packaging. The use of deposit-return schemes and other incentives, such as setting quantitative targets, taking reuse into account for the attainment of recycling targets, and differentiated financial contributions for reusable packaging under extended producer responsibility schemes for packaging. Kazakhstan should take measures to increase incentives of the take-up of reusable packaging and to achieve a reduction in consumption of packaging that is not recyclable and of excessive packaging.

As a long term policy Kazakhstan can adopt more developed system of municipal waste management sorting system, investing in promotion of separate collection principle with a help of social media, television and other innovative technological means. Chances of public interest in that kind of project could increase where publicly well-known people are involved. This is one of the tools to help distribute idea and increase awareness of separation of municipal solid among population of Kazakhstan.

5. Conclusion

In this thesis I have performed an extensive analysis on waste management of Kazakhstan and Austria. The thesis introduction contains a general overview of economic situations in named countries. Next chapters contain a presentation and analysis of waste management systems in both countries, as well as a comprehensive analysis of legislation.

One of the first finding is that from the legislative system point of view, Austria has developed a inclusive line of laws, starting with the Waste Management Act 2002. Furthermore, 9 Waste Management Acts of the provinces are significant regulations in this area. I have also observed that as the EU become an important driver for policies on environmental law, these were transposed into national laws in Austria. Therefore, European legislation regarding environmental issues, waste management, was taken into consideration in this thesis. Waste treatment in Austria has to comply with principles of the Federal Waste Management Plan that is being issued every 6-7 years. I believe that document comprises the most important data tracking implementation of Austrian regulations, and is one of the reference points in terms of potentially good practices that could be applied in other countries.

On the other side, one of the main legislative acts in Kazakhstan is the Environmental Code. This stipulates main requirements and procedures related to environmental issues, and in particular waste management issues. As part of this research, certain data and statistics on waste generation, recycling rates in

Kazakhstan was difficult to find. Based on this, I conclude that development of a comprehensive policy regulating waste management would solve this problem and set up this issue as a priority for the country. Having open data available in this domain, would give more information to the public and researchers. This would ultimately reflect in a better overview, monitoring, but also for improvement purposes as this data would serve as input in research and case studies on waste management. This type of report could be a start of holistic approach in a waste legislation of Kazakhstan and increase transparency in policy development and programs. As a young country with an economy in transition, Kazakhstan is seeking for the most developed system of the environmental protection as a working system to be implemented. In this period of development the country is running projects in cooperation with international organizations such as OECD, World Bank, UNDP.

Concept of transition of the Republic of Kazakhstan to a Green Economy lays the foundations profound systemic changes in order to switch to a new form of economy by improving the welfare, quality of life of the population of Kazakhstan and the country's entry into the top 30 most developed countries in the world, while minimizing the impact on the environment and the degradation of natural resources. In this regard, Austria is one of the most effective countries to cooperate in this field.

Following the concept of green technologies and sustainable development, there are plans to obtain energy from processing waste, “waste to energy” program. Kazakhstan is considering the possibility of implementing the Waste-to-energy project, which implies the introduction of principles for the processing of municipal solid waste into energy.

To date, the Government of Kazakhstan has adopted a number of development strategies and programs and action plans aimed at sustainable growth, but it is clear that fundamental problems should be solved, while efforts at cooperation on municipal level are limited in terms of their effectiveness.

The transition to green growth will require effective coordination among authorities, national and international investor, business and society as a whole. As a result, the joint implementation of public policies will lead to dynamic and sustainable economic growth that will be resilient to adverse economic and environmental changes.

Austria experience represents a good example for Kazakhstan in terms of technologies in constructing landfills, efficient disposal methods including incineration, diverse material recovery methods with high rates of recycling. Having the same amount of municipal solid waste generated during the year, recycling rates in Austria are almost 9 times higher. This can be in general a good example for countries who are on the early stage of waste management development of how waste treatment plants should work efficiently, including Kazakhstan. Development of waste preventive measures, developed system of separate collection of MSW, implementing circular economy measures.

Another observation as part of this research was the amount of municipal solid waste in Kazakhstan. If we consider the generation of MSW, there is a high amount of packaging as a component of municipal solid waste in the capital. Therefore, in order to promote waste prevention and prepare packaging for reuse and recycling, developing regulations on this specific type of waste on the base of Packaging Ordinance is important.

Additionally, regulations for commercial packaging, transferring obligation to a collection and recycling system, system of participation by downstream and upstream levels is one of the good examples for Kazakhstan, that was successfully implemented in Austria.

Considering EU experience, where policies are drafted based on all inputs from the member states and are issued as guidance or mandatory requirements, I believe such policies at the global level would be welcome. United Nations is one potential organization that could issue such requirements and policies, to help all member states improve their waste management policies and systems in general. Whereas, such recommendations and policies do exist, I further

recommend that recommendations are timely adjusted and updated. The input from regional organizations, such as the EU, could be also considered.

However, for the scope of this research, I believe that 1:1 cooperation is a good opportunity. The policy could be improved in Kazakhstan by first having a dedicated policy for this topic, instead of having this combined in a high level policy on more environment related topics. Based on the example of Austria, having a dedicated policy is a good practice in my opinion. This shows importance of this topic, recognized by the Parliament, but also it correlates indirectly to the resources allocated to implement it.

As part of this thesis, I have also identified potential future research topics. These relate to the frameworks and procedure to implement and update waste management policies. Even if each country is individual and has different set up in terms of political system, these are aspects that we have described, such as development of comprehensive policy document, including all relevant data on waste management, enforcement of cooperation programs, implementing best practices, ensuring ability of all mechanisms on every level work, all that could be set as high level objects for any country wishing to update elements in their legal framework.

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