

## PROJECTION REGARDING THE MUNICIPAL WASTE GENERATION IN TIMIȘ COUNTY 2019-2048

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**Abstract:** Waste is not only an environmental problem but also an economic loss. On average, Europeans produce 481 kilograms of municipal waste per year. Romania generates many constructions and demolition waste, mining waste, industrial waste, and the list goes on. The primary purpose of the paper is the projection on the generation of municipal waste, in Timiș County, in order to raise awareness of the urgent need for more efficient waste management, but and our involvement in the importance of the separate collection of waste generated daily, which in the future will have repercussions on the high degree of pollution that affects our health and the environment. In this regard, the authors propose that investors consider the Environmental Sectorial Operational Program (SOP Environment), which promotes integrated waste management projects that reflect EU policy and principles in this environmental sector following the National Waste Management Plan and the Plans. Regional Waste Management.

**Key words:** projection, municipal waste, Timiș county, Romania

### INTRODUCTION

Romania generates substantial amounts of waste, starting with food and gardening waste and continuing with construction and demolition waste, mining waste, industrial waste, sludge, old TVs, old cars, batteries, plastic bags, paper, sanitary waste, old clothes, and old furniture, and the list goes on.[6]

The amount of waste we generate is closely linked to our consumption and production patterns. The vast number of products entering the market is another challenge. Demographic changes, such as the increase in the number of single-person households, also affect the amount of waste we generate.[2, 8]

European waste policy and legislation align with more comprehensive Community policies and programs, including the Environment Action Program 7, the Roadmap to an Energy Efficient Europe, and the Raw Materials Initiative.[1, 7]

In November 2013, the European Parliament and the European Council adopted the 7th Environment Action Program - 2020, "Living well, within the limits of our planet." The vision of this program, which aims to guide EU action in the field of environmental protection and climate change by 2020, is that "In 2050 we will live well within the ecological limits of the planet. Our prosperity and environmental health result from an innovative circular economy where nothing is wasted, thrown away, and where resources are managed sustainably".[9, 10]

### MATERIALS AND METHODS

The County Waste Management Plan (PJGD) for Timiș County will cover 2019-2025, having as the reference year 2018.[11]

The period covered by the generation forecast regarding the quantities of waste to be managed 2019 - 2048, and the planning period is 2019 - 2025. The assumptions based on which this estimate will be made are the following:

*Household waste generation indicators* - given that the indicators estimated in the analysis of the current situation are higher than those estimated in The National Waste

Management Plan (PNGD), according to the Methodology for elaborating the PJGDs (Order 140/2019), the estimated indicators will be used to analyze the current situation;[11, 12]

*The degree of service of the population with the sanitation service* - the values identified in the analysis of the current situation will be used, but it starts from the premise that from the level of 2020, the degree of coverage with sanitation services is 100%, due to the commissioning of Integrated Waste Management System Timiș;[8]

*Similar waste* - will be calculated as a share of household waste in each environment in 2018 (the similar waste in urban areas represents 31.17% compared to household waste and in rural areas 18.6% of household waste);[14]

*Waste from gardens and parks, waste from squares, and street waste*- the quantities identified to be generated from the analysis of the current situation will be used. It is assumed that these quantities will not change during the forecast period.[1]

For the projection of the quantity of municipal waste generated in the period 2018-2025, the following hypotheses are used, provided in PNGD:

Indicators for household waste generation in both urban and rural areas:

- In the reference year, 2018, the generation indicator is the one from the analysis of the existing situation;
- From 2019 until the end of the planning period (2048), the indicators remain constant.[4, 14]

Regarding the degree of connection of the population to the sanitation service, in 2019, the county's entire population is served by sanitation services. According to the SIMD Timiș Project, but also the PNGD provisions, from the level of 2019, the served population of the county is 100% both in urban and rural areas;[12]

Similar waste represents the share calculated from household waste for the entire planning period; it is assumed that percentages set at the level of 2019 will be kept for the entire forecast period;[3]

Park and garden waste, market waste, and street waste remain constant, at the estimated value for the first forecast year for the entire planning period. For the rural environment, no generation of such waste was taken into account.[11]

## RESEARCH RESULTS

The following categories of waste will be taken into account, for which there are objectives and targets to be achieved according to the legislation in force and the strategic documents (PNGD 2014-2020), and which are subject to MDS: Household waste; Similar wastes; Biodegradable waste; Street waste; Waste from markets; Waste from parks and gardens; Hazardous household waste; Bulky waste.[12, 13]

According to the data registered at the Agency for Environmental Protection (APM) Timiș, the population served by sanitation services registers variations in the urban environment (thus, in 2013, it was 91.41% of the urban total 2018 reaching 199.62%). In rural areas in 2013, the generation index was 83.71% of the rural total, reaching fluctuations in 2018 to 89.58%.

Given that practically, at the level of 2019, from the data collected from the sanitation operators, all from administrative-territorial Units (ATU) from Timiș County benefited from the services of a sanitation operator, it was considered in the projection calculations a coverage with sanitation services of 100% for both urban and rural areas, following the provisions of PNGD 2014-2020.[12]

Regarding the indices of household waste generation, for the period 2013-2018, they were calculated from the validated statistical data of APM Timiș and the data reported by the Association for Intercommunity Development of Waste (ADID) Timiș. During 2016-2018 (when SIMD Timiș started operating), generation indices show an upward trend

in urban and rural areas[15]. Given that the latest data on waste is at the level of 2018, the calculations on the projection of generation indices had as the reference year 2018. Thus, for the urban environment was calculated the generation index of 0.77 kg/place/day, with a constant trend for the next period and in rural areas, the generation index of 0.52 kg/place/day was calculated, with a constant trend for the next period (Table 1.).

**Table 1.**

**Projection of household waste generation indicators, 2018-2025**

Household waste generation indicator (kg/place x day)	2018	2019	2020	2021	2022	2023	2024	2025
<i>Urban environment generation</i>	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77
<i>Rural environment generation</i>	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52

Source:ADID Timiș, 2018 [2]

Regarding the generation indices of the other categories of municipal waste and their projection, the following premises were taken into account:

At the level of 2018, for similar waste, the share of their quantities compared to the quantities of household waste generated was calculated at the level of the entire county, depending on the quantities collected, their values being as follows:

- *similar urban waste* - 31.17% of the amount of household waste generated in the urban environment;
- *similar rural waste* - 18.6% of the amount of household waste generated in rural areas;

In accordance with the premises of PNGD 2014-2020 (which calculates the quantities of similar waste as a percentage of household waste), these percentages were used to project the quantities of similar waste. These percentages were kept constant over the forecast period. For waste from markets, parks and gardens, and streets, following PNGD 2014-2020, a constant trend was maintained during the forecast period; respectively, the amount of waste generated was kept constant.[12]

Based on the above premises, the projection of municipal waste generation is presented in table number two.

**Table 2.**

**Municipal waste generation forecast, in Timiș County, 2019-2025**

<b>TOTAL COUNTY (tons)</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>
Household waste collected in a mixture and separately	172,944	173,578	173,637	173,696	173,756	173,816	173,875
Similar wastes from trade, industry, mixed and separate collected institutions	46,906	46,983	46,999	47,015	47,031	47,047	47,063
Waste collected from gardens and parks	154	154	154	154	154	154	154
Waste collected from markets	772	772	772	772	772	772	772
Collected street waste	12,235	12,235	12,235	12,235	12,235	12,235	12,235
<b>Total municipal waste collected</b>	<b>233,011</b>	<b>233,722</b>	<b>233,797</b>	<b>233,872</b>	<b>233,948</b>	<b>234,024</b>	<b>234,099</b>
<b>Total municipal waste generated</b>	<b>233,011</b>	<b>233,722</b>	<b>233,797</b>	<b>233,872</b>	<b>233,948</b>	<b>234,024</b>	<b>234,099</b>
<b>Urban environment (tons)</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>
Household waste collected in a mixture and separately	117,244	116,915	116,954	116,994	117,034	117,074	117,114
Similar wastes from trade, industry, mixed and	36,545	36,443	36,455	36,468	36,480	36,492	36,505
Waste collected from gardens and parks	154	154	154	154	154	154	154
Waste collected from markets	772	772	772	772	772	772	772
Collected street waste	12,235	12,235	12,235	12,235	12,235	12,235	12,235
<b>Total municipal waste collected</b>	<b>166,950</b>	<b>166,519</b>	<b>166,570</b>	<b>166,623</b>	<b>166,675</b>	<b>166,727</b>	<b>166,780</b>
<b>Total municipal waste generated</b>	<b>166,950</b>	<b>166,519</b>	<b>166,570</b>	<b>166,623</b>	<b>166,675</b>	<b>166,727</b>	<b>166,780</b>

Rural area (tons)	2019	2020	2021	2022	2023	2024	2025
Household waste (collected in mixture and separated)	55,700	56,663	56,683	56,702	56,722	56,742	56,761
Similar wastes from trade, industry, institutions (collected in the mixture and separately)	10,361	10,540	10,544	10,547	10,551	10,555	10,558
<b>Total municipal waste collected</b>	<b>66,061</b>	<b>67,203</b>	<b>67,227</b>	<b>67,249</b>	<b>67,273</b>	<b>67,297</b>	<b>67,319</b>
<b>Total municipal waste generated</b>	<b>66,061</b>	<b>67,203</b>	<b>67,227</b>	<b>67,249</b>	<b>67,273</b>	<b>67,297</b>	<b>67,319</b>

Source: PJGD Timiș, 2020, [11]

### Projection of municipal waste composition

When making the projection on the composition of waste for the period 2019-2025, the following hypotheses will be taken into account:

- *For household and similar waste in the period 2019 - 2025:*

The percentage of plastic waste will show a decreasing trend compared to that of 2018, as a result of the implementation of European legislation on the phasing out of plastic packaging;[11]

The percentage of paper/cardboard waste shows a decreasing trend compared to the level of 2018, according to the PNGD trend;

The percentage of glass waste shows a slight decrease of up to 4.07% according to the PNGD trend for glass, as a result of the introduction of the storage system for reusable packaging;[12, 12]

The percentage of biowaste will show a decrease of up to 51.37% (according to the PNGD trend) as a result of the implementation of measures to prevent the generation of food waste;

The percentage of metal waste registers an increasing trend up to 4.08% according to the trend in PNGD;

The percentage of wood waste will show an increasing trend, according to the PNGD trend;

The percentage of textile waste will show a staged increase to a constant value of 0.75% (according to the PNGD trend);[12]

- *In the period 2026 - 2048:* the composition will remain constant.

The composition of the household and similar waste is shown in Table Three.

**Table 3.**

### Forecast of the composition of the household and similar waste in Timiș County, by averages, 2019-2025

URBAN	Composition (%)						
	2019	2020	2021	2022	2023	2024	2025
paper / cardboard	15.02	15.21	15.40	15.58	15.77	15.96	16.15
plastic	14.41	14.22	14.04	13.85	13.66	13.47	13.29
glass	4.44	4.38	4.32	4.25	4.19	4.13	4.07
wood	1.88	1.90	1.93	1.95	1.98	2.00	2.03
biodegradable	53.25	52.94	52.62	52.31	52.00	51.69	51.37
metal	2.80	3.01	3.23	3.44	3.65	3.86	4.08
text	0.00	0.13	0.25	0.38	0.50	0.63	0.75
others (including bulky)	8.20	8.22	8.23	8.24	8.25	8.27	8.28
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00

RURAL	2019	2020	2021	2022	2023	2024	2025
paper / cardboard	15.02	15.21	15.40	15.58	15.77	15.96	16.15
plastic	14.41	14.22	14.04	13.85	13.66	13.47	13.29
glass	4.44	4.38	4.32	4.25	4.19	4.13	4.07
wood	1.8	1.90	1.93	1.95	1.98	2.00	2.03
biodegradable	53.25	52.94	52.62	52.31	52.00	51.69	51.37
metal	2.80	3.01	3.23	3.44	3.65	3.86	4.08
text	0.00	0.13	0.25	0.38	0.50	0.63	0.75
others (including bulky)	8.20	8.22	8.23	8.24	8.25	8.27	8.28
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: PNGD 2017, PJGD Timiș 2020

Regarding the forecast of the composition of waste from parks and gardens, market waste, and street waste, in the absence of exact determinations at the county level on the composition of these categories, it will remain constant throughout the planning period (2019-2048), according to the percentages recommended in the PNGD and shown in Table 4.

**Table 4.**  
**Forecast of waste composition in parks and gardens, markets and streets, 2018-2025**

Waste from parks and gardens	Composition (%)							
	2018	2019	2020	2021	2022	2023	2024	2025
paper / cardboard	0	0	0	0	0	0	0	0
plastic	0	0	0	0	0	0	0	0
glass	0	0	0	0	0	0	0	0
wood	0	0	0	0	0	0	0	0
biodegradable	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1
metal	0	0	0	0	0	0	0	0
text	0	0	0	0	0	0	0	0
bulky	0	0	0	0	0	0	0	0
more	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
<b>Waste from markets</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>
paper / cardboard	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9
plastic	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
glass	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
wood	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
biodegradable	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0
metal	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
text	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
bulky	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
more	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
<b>Street waste</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>
paper / cardboard	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1
plastic	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7
glass	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
wood	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
biodegradable	60.2	60.2	60.2	60.2	60.2	60.2	60.2	60.2
metal	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Inert *	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
more	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3

Source: PNGD 2017

**Projection on the generation of municipal biodegradable waste**

The projection on the generation of municipal biodegradable waste is fundamental in designing the integrated waste management system both in establishing measures for the recycling of municipal waste and the objective of reducing the disposal of municipal biodegradable waste.

Quantities of municipal biodegradable waste are calculated based on the forecast for municipal waste generation and consider the share of biodegradable waste in municipal waste (according to the composition data).

The quantities of biodegradable waste estimated for the urban environment are shown in Table Five.

**Table 5.**

**Projection of biodegradable waste quantities, 2018-2025**

Name	Quantity (t)							
	2018	2019	2020	2021	2022	2023	2024	2025
<b>TOTAL BIODEGRADABLE WASTE</b>	<b>91,821</b>	<b>91,609</b>	<b>91,047</b>	<b>90,429</b>	<b>89,812</b>	<b>89,198</b>	<b>88,586</b>	<b>87,976</b>
Household waste collected in a mixture and separately	71,752	71,575	71,103	70,585	70,069	69,555	69,043	68,534
<i>food and garden waste</i>	53,292	53,062	52,613	52,131	51,650	51,172	50,695	50,220
<i>wood</i>	3,833	3,844	3,839	3,832	3,825	3,817	3,810	3,803
<i>paper + cardboard</i>	14,627	14,669	14,650	14,622	14,594	14,567	14,539	14,511
Assimilable waste from trade, industry, mixed and separate institutions	14,074	14,039	13,950	13,849	13,748	13,648	13,548	13,448
<i>food and garden waste</i>	10,453	10,408	10,322	10,228	10,134	10,041	9,947	9,854
<i>wood</i>	752	754	753	752	750	749	748	746
<i>paper + cardboard</i>	2,869	2,877	2,874	2,869	2,864	2,858	2,853	2,847
Waste from gardens and parks	1,325	1,325	1,325	1,325	1,325	1,325	1,325	1,325
Waste from markets	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680
<i>paper + cardboard</i>	160	160	160	160	160	160	160	160
<i>biowaste</i>	1,496	1,496	1,496	1,496	1,496	1,496	1,496	1,496
<i>wood</i>	24	24	24	24	24	24	24	24
Road waste	2,990	2,990	2,990	2,990	2,990	2,990	2,990	2,990
<i>paper + cardboard</i>	413	413	413	413	413	413	413	413
<i>biowaste</i>	2,459	2,459	2,459	2,459	2,459	2,459	2,459	2,459
<i>wood</i>	118	118	118	118	118	118	118	118
	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>
<b>Total urban biodegradable waste</b>	<b>75,049</b>	<b>74,878</b>	<b>74,017</b>	<b>73,466</b>	<b>72,916</b>	<b>72,369</b>	<b>71,825</b>	<b>71,283</b>
Household waste collected in a mixture and separately	57,820	57,677	56,956	56,494	56,034	55,576	55,121	54,667
<i>food and garden waste</i>	42,945	42,759	42,145	41,724	41,305	40,887	40,472	40,059
<i>wood</i>	3,089	3,098	3,075	3,067	3,059	3,050	3,042	3,033
<i>paper + cardboard</i>	11,787	11,820	11,736	11,703	11,671	11,639	11,607	11,575
Assimilable waste from trade, industry, institutions, collected mixed and separately	11,234	11,206	11,066	10,976	10,887	10,798	10,709	10,621
<i>food and garden waste</i>	8,344	8,308	8,189	8,107	8,025	7,944	7,863	7,783
<i>wood</i>	600	602	598	596	594	593	591	589
<i>paper + cardboard</i>	2,290	2,297	2,280	2,274	2,268	2,261	2,255	2,249
Waste from gardens and parks	1,325	1,325	1,325	1,325	1,325	1,325	1,325	1,325
Waste from markets	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680
	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>
<i>paper + cardboard</i>	160	160	160	160	160	160	160	160
<i>biowaste</i>	1,496	1,496	1,496	1,496	1,496	1,496	1,496	1,496
<i>wood</i>	24	24	24	24	24	24	24	24
Street waste	2,990	2,990	2,990	2,990	2,990	2,990	2,990	2,990
<i>paper + cardboard</i>	413	413	413	413	413	413	413	413
<i>biowaste</i>	2,459	2,459	2,459	2,459	2,459	2,459	2,459	2,459
<i>wood</i>	118	118	118	118	118	118	118	118

Source: PNGD 2017, PJGD Timiș 2020 [10, 9]

## CONCLUSIONS

A member of the European Union, Romania has an obligation to assume and, at the same time, the interest to align its infrastructure at a level comparable to that of other Member States to remedy this state of affairs, which will lead to improved quality of life, and the health of its inhabitants, as well as the protection of the environment. To this end, it is necessary to mobilize material, financial, and human resources in the context of planned and organized actions at the central and local levels.[16]

The Sectoral Operational Program Environment (SOP Environment), whose global objective is to protect and improve the quality of the environment and living standards in Romania, aiming to comply with the provisions of environmental legislation, promotes integrated waste management projects that reflect EU policy and principles from this environmental sector under the National Waste Management Plan and the Regional Waste Management Plans.

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