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MUNICIPAL WASTE MANAGEMENT IN SERBIA

SITUATIONAL ANALYSIS

May 2023

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Acknowledgements

This report was supported by the Sustainable Urban and Regional Development program (SURGE), a World Bank Umbrella Multi-Donor Trust Fund financed by the Swiss State Secretariat for Economic Affairs (SECO).

The preparation of the report was led by Carli Venter with support from Jan Grotmann-Hoefling and Nikola Doychinov. The report benefited from significant inputs from Dusan Milovanovic, Dejan Ubavin, Aleksej Stepanov, Olivera Antic, Tamara Nikolic and Darko Milutin. The team is grateful for administrative support from Lisa Fonick Haworth and Nejme Kotere.

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Abbreviations

AD	Anaerobic Digestion
AFD	Agence française de développement
DRS	Deposit Refund Scheme
EBRD	European Bank for Reconstruction and Development
EC	European Commission
EEA	European Environment Agency
EIB	European Investment Bank
EPR	Extended Producer Responsibility
EU	European Union
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
IFC	International Finance Corporation
IPA2	Instrument for Pre-accession Assistance 2
KfW	Kreditanstalt für Wiederaufbau
LSG	Local self-government
MBT	Mechanical-biological treatment
MEP	Ministry of Environmental Protection
MIGA	Multilateral Investment Guarantee Agency
MRF	Materials Recovery Facility
NWMP	National Waste Management Plan
OeEB	Oesterreichische Entwicklungsbank AG
PET	Polyethylene terephthalate
PPP	Public Private Partnership
PRO	Producer Responsibility Organization
PUC	Public utility company
RDF	Refuse derived fuel
RS	Republic of Serbia
RSD	Serbian dinar
RSL	Regional Sanitary Landfill
RWMC	Regional Waste Management Center
RWMP	Regional Waste Management Plan
SEPA	Serbian Environmental Protection Agency
WEEE	Waste of Electrical and Electronic Equipment
WMS	Waste Management Strategy
WtE	Waste-to-energy

Rate of exchange: EUR 1 = RSD 117.324

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Executive Summary

This report provides a baseline analysis of the existing situation in the municipal waste management sector in Serbia and underscores the importance of the sector in terms of achieving Sustainable Cities objectives. Reforms in the waste sector are a key component of a larger government commitment to a Green Transition. Ambitions to significantly improving the solid waste management system, in line with EU requirements, is well reflected in recently adopted policies and plans including the National Waste Management Program for the period 2022 – 2031. There is a significant focus on the establishment of much needed basic disposal infrastructure. However, implementation remains slow, and some waste related targets will require further alignment and adjustment as the EU landscape continues to evolve.

Waste Management Legislation, Strategies and Institutions

In terms of the overall legislative, regulatory and institutional landscape, the most significant shift has been the move towards greater regionalization of waste management services, treatment and disposal. The establishment of Waste Management Regions (28 planned in total) also requires the drafting of Regional Waste Management Plans (RWMP), with the mandatory requirement for two or more Local Self Government (LSG) units with at least 250,000 residents to draft such a plan. Regional structures are established through inter-municipal cooperation agreements between LSG units. To date, regional waste management companies have been established in 13 regions, and another 12 regions have signed inter-municipal agreements, but regional companies have not been established yet. There are no special instruments or requirements on how to develop regional infrastructure and implement service delivery, with choices such as the number and location of transfer stations, processing facilities, landfill locations and other parts of the system left to members of each region to agree on internally.

LSG Units remain largely responsible for municipal waste management activities, even with the stronger regional focus. LSG units are required to adopt local waste management plans and have responsibilities to implement such plans, manage non-hazardous (including municipal) and inert waste on their territories, set service fees and tariffs, issue permits and other acts, supervise and control waste management measures, maintain records and report on waste management activities. The majority of the responsibilities are delegated to public utility companies (PUCs), which are owned and managed by the LSG units and provide collection, transport, treatment and disposal services.

The Ministry of Environmental Protection (MEP) is the central authority in charge of waste management and oversees the implementation of waste-related legislation. The Environmental Inspectorate within the Ministry is responsible for enforcing environmental sanctions and inspecting the facilities for which the Ministry issues permits. The Serbian Agency for Environmental Protection (SEPA) is largely responsible for record keeping and managing publicly available waste data. The MEP supervises the work of SEPA, the Autonomous Province, LSG units, as well as authorized legal entities, in performing various delegated tasks. The control activities are performed by the inspectors for environmental protection. Cities and municipalities are also entrusted with inspection supervision over activities of collection, transport, treatment, storage, reuse, and disposal of inert and non-hazardous waste, for which they have issued a permit.

Municipal Waste Management System

In 2020, 2.95 million tons of municipal waste[1] were generated, with 2.83 million tons reported as collected and then landfilled or recycled. Other reported figures show an average collection system coverage of only 86.4 percent, indicating that a significant portion of waste remains uncollected. Service coverage varies greatly between LSG units and their PUCs that carry out municipal waste collection and disposal services. In urban areas waste is usually collected twice a week or more, while in rural areas and in areas where each household has its own waste bin, the most common collection frequency is once a week.

According to the NWMP, around 482,000 tons of municipal solid waste were collected separately in 2020. Of this, around 47 percent (226,000 tons per year) can be attributed to separately collected packaging waste through Serbia's "collective schemes" with the majority of separately collected packaging waste is from industrial and commercial origin or results from informal sector activities. A limited number of LSG units have established waste collection centers ("recycling yards") or implemented separate household collection using a two-bin system for recyclables and residual waste. The informal sector plays a key role in recycling in the country, with a variety of materials received from waste pickers who often specializing in specific recyclables.

The management of packaging waste in Serbia is based on the extended producer responsibility (EPR) principle and regulated by the Law on Packaging and Packaging Waste (LPPW). According to LPPW, each company that places more than 1 ton of packaging on the market within the Republic of Serbia is obliged to meet the national targets defined by the MEP. In 2020, 362,236 tons of packaging were placed on the market of the Republic of Serbia and seven operators ("collective schemes") hold a permit to establish an EPR system for packaging waste. In 2020, out of the 362,236 tons of packaging placed on the market, almost all was reported by legal entities or entrepreneurs who transferred their obligations to the collective schemes. Significant improvement is possible through a stronger focus on separate packaging waste collection from households and a review of the declared packaging quantities placed on the market, which seem low when considering waste composition data. Results achieved in terms of system development of separate collection schemes, sorting and recycling infrastructure are not satisfactory and several issues requires attention.

Waste sorting infrastructure is underdeveloped and the separate collection and treatment of biowaste is also rare in Serbia. There is a strong focus on developing the necessary infrastructure and systems to reduce the disposal of biodegradable waste in landfills in the NWMP. This includes plans for home composting and local composting as well as the development of more centralized biological treatment plants. However, while the NWMP includes the introduction of separate collection of green waste during a first implementation phase, the separate collection of biodegradable waste in all waste management regions would only be fully implemented by 2039.

[1] In line with the amendments to the EU Waste Framework Directive and the proposed amendments to the Law on Waste Management, municipal waste is defined as separately collected household waste, including paper and cardboard, glass, metal, plastic, biowaste, wood, textiles, packaging, waste electrical and electronic equipment, waste batteries and accumulators, bulky waste and mixed municipal waste and/or separately collected waste from other sources, if such waste is similar in nature and composition to household waste.

The majority of collected municipal waste is disposed of in landfills without preliminary treatment, and the majority of waste is still disposed of in non-compliant landfills and dumpsites. Of the 2.37 million tons of municipal solid waste reported as landfilled in 2020, only around 560,000 tons were disposed of in regional sanitary landfills. In addition to 12 regional sanitary landfills, there are 135 municipal landfills that do not comply with environmental standards and 2,656 illegal dumps. Estimations are that about 20 percent of the generated municipal waste in the Republic of Serbia ends in illegal dumps.

Financing of Waste Management Services

The NWMP provides national cost estimates (totalling €1,051 million) for implementing planned measures in several phases, separately for meeting the EU's Landfill Directive and the Waste Framework Directive. It is expected that the private sector will cover around 40 percent of the required investments, and despite the small share of around 7 percent expected from LSG units, these and the associated PUCs are severely resource constrained. LSG units set their own fees and the current low levels of household fees for waste management services also reflect the poor and non-compliant infrastructure in the sector. In terms of the NWMP there are longer term plans to move towards utility fees based on the "polluter pays" principle, with full-cost recovery, and follow the principle of affordability. Several economic instruments are also under consideration to incentivize improved waste management, including product taxes on specific types of packaging, landfill taxes and a deposit refund scheme for beverage containers. International donors and development agencies also support Serbia through a mix of budgetary financing and project financing towards meeting environmental objectives.

Recommendations

While the planned investments are crucial for achieving the goals set out in the NWMP, more must be done to put Serbia's solid waste management system on sustainable development path in the long-term. Recommendations following the assessment are mostly directed at the national level, and are as follows:

i) **Data and Reporting:** Incomplete, incorrect or non-existent data on waste generation, treatment and disposal creates obstacles in planning processes and hampers oversight and monitoring. Current efforts to improve reporting in the sector should continue and be prioritized.

ii) **Targets and Policies:** Plans and strategies in the waste sector should be regularly reviewed, addressing recycling targets and landfill diversion objectives as these continue to evolve at EU level**.** Operationalizing the 2022 – 2024 Circularly Economy Development Program should include a much stronger focus on waste prevention and food waste. National targets could also be devolved with clearer guidance to regional and local level.

iii) **Inter-Municipal Cooperation:** The procurement of waste management services and establishment of common regional treatment and disposal infrastructure would benefit from clear implementation mechanisms to support inter-municipal cooperation. The MEP could take a more active role in coordinating implementation of new regional waste management systems, including

appropriate guidelines and enforcement mechanisms to support the development of new waste treatment infrastructure

iv) **Full Cost-Recovery, Financing, and Private-Sector Participation:** Clear policies and guidance is required in terms of defining and setting tariffs for households and legal entities. The introduction of full-cost recovery will require political commitment on national and local levels and is crucial for encouraging private-sector participation in solid waste management. The main focus of private sector involvement should be technically complex activities/projects and services that require significant investments and operational budgets.

v) **Collection Systems and Extended Producer Responsibility (EPR):** A significant increase in collection coverage and separate collection of recyclable waste streams and biowaste should be considered as important as the establishment of regional treatment and disposal infrastructure. Technical requirements and standards for separate waste collection and sorting in parallel with EPR schemes could allow the implementation of a limited number of preliminary defined separate collection alternatives by the local government authorities in Serbia. The EPR scheme can be significantly improved through firstly an in-depth analysis of the division of responsibilities between LSG units, service providers (mostly PUCs), and PROs. The establishment of a coordination mechanism at national level including representatives of state institutions, local authorities, PUCs, PROs, waste management companies, and the recycling industry would support better planning at all levels**.**

vi) **Stakeholder Engagement, Awareness Raising and Capacity Building:** Increasing awareness is needed to support the separation at source but also to promote new production and consumption models. It is recommended that a national stakeholder engagement and communications strategy that clearly sets out how to reach out to major stakeholders and increase awareness regarding guiding principles, national goals, and priorities for improving the country's solid waste management system. Peer learning opportunities at local level, based on existing good practice cases in Serbia, also offer an excellent opportunity to improve performance at LSG level.

1 Introduction

The report represents a rapid assessment of the solid waste sector in Serbia and underlines its importance for the sustainability agenda in Serbian cities. The report forms the analytical foundation for one of several streams of work as part of the World Bank (WB) program „Green, Livable, and Resilient Cities in Serbia", supported by the Swiss State Secretariat for Economic Affairs (SECO). Solid waste management practices have a direct impact. Managing waste is most often assigned as a responsibility to local government, as is also the case in Serbia. Managing and operating integrated waste management systems in a cost-effective manner, while simultaneously initiating actions to reduce and recycle waste, is essential for building sustainable and livable cities.

Serbia has a long-term objective to implement advanced waste management systems in line with EU requirements in the sector. The recently adopted Serbian National Waste Management Program for the period 2022 – 2031 (NWMP) focusses on the establishment of much needed basic disposal infrastructure. The recycling targets for packaging waste are aligned with EU requirements and a significant increase in quantities of recycled biowaste and related diversion of biodegradable waste designated to landfilling is envisaged over the program implementation period. Reforms in the waste sector are a key component of a larger government commitment to a Green Transition and would also require the development of Circular Economy strategies and to the construction and maintenance of appropriate waste management infrastructure (World Bank 2022).

While the European Commission attests Serbia a good level of alignment with the EU acquis, the policy objectives and targets established in the NWMP leave room for further alignment. The planning horizon for large scale investments in waste treatment infrastructure such as landfills, incineration plants, and mechanical-biological treatment facilities is at least 20 years. The future harmonization of Serbian national legislation with EU requirements will substantially change the legal framework to plan, build and operate such facilities. There is a substantial risk that recently established or planned waste treatment facilities become obsolete or do not comply with new policy objectives, leading to substantial impact on their financial viability and technical compliance.

Even though Serbia has received considerable technical assistance from the EU and other donors, implementation and progress in the sector remains slow. Support has been received in areas such as the formulation of policy actions, strengthening of institutional capacities and developing guidelines directed towards specific issues. The following challenges were identified:

- There is insufficient population coverage by the municipal waste collection services (estimated at 82 percent) with significant room for improvement.
- Landfills are the prevalent destination for municipal solid waste with a great number of non-compliant landfills still present throughout the country. Some progress has been made towards the establishment of new regional sanitary landfills and municipal waste treatment facilities but ending disposal in non-compliant landfills and achieving landfill diversion targets remains a challenge.
- The preliminary treatment of municipal waste prior to landfilling is practically not applied and only a few facilities are operational in the country.

- Systems for the separate collection of recyclables from households like paper and cardboard, plastics, glass and metals are not well established. The extended producer responsibility (EPR) schemes for packaging waste, waste from electrical and electronic equipment (WEEE), batteries and accumulators are developed to a different extend and there is no clear view how EPR schemes can contribute to achieving municipal waste recycling targets.
- While guidelines have been developed, mechanisms to support intermunicipal cooperation in organizing common services between local authorities and the establishment common treatment and disposal infrastructure are not fully realized.
- The municipal waste service tariffs are low and do not achieve full cost recovery, which is a considerable obstacle for private investments and engagement in the sector.
- The lack of reliable data about quantities and composition of municipal waste generated, collected, recovered and disposed is an additional challenge for planning the necessary treatment and disposal infrastructure.

This report aims to provide a baseline analysis of existing situation in the municipal waste management sector, identify main obstacles for increasing recycling of waste, and recommend possible actions to improve Serbia's municipal waste management system. Attention is given to waste management legislation, strategies, and institutions (chapter 2), Serbia's waste management system including the existing Extended Producer Responsibility scheme (chapter 3), and the financing of waste management services (chapter 4). Chapter 5 outlines a set of recommendations to develop a modern and EU compliant municipal waste management system.

2 Waste Management Legislation, Strategies and Institutions

2.1 Waste Management Legislation and the National Waste Management Program

Waste management legislation and policies in Serbia are strongly influenced by EU requirements and the European Commission attests Serbia "a good level of alignment with the EU acquis; however, implementation remains at an early stage" (EC 2022). The main laws covering municipal solid waste are the *Law on Waste Management* and the *Law on Packaging and Packaging Waste Management*, both being currently under revision to achieve further harmonization. Serbia's *National Waste Management Strategy for the Period 2010–2019* (WMS) emphasized harmonization with EU legislation and set the conditions for the establishment and development of an integrated waste management system in the Republic of Serbia.

The WMS was succeeded by Serbia's National Waste Management Program (NWMP) for the period 2022 – 2031, which established new waste management goals for the development of an integrated waste management system. The NWMP determines the basic principles that should guide all actors in waste management to achieve these goals in the Republic of Serbia for the period 2022-2031. The NWMP's general objective is to "develop a sustainable waste management system in order to conserve resources, the health of the people and reduce negative environmental impacts and space degradation" (RS 2022). This includes the prevention of waste generation, the reduction of recyclable waste disposed of in landfills, the reduction of the share of the biodegradable fraction in municipal waste, the reduction of the negative impact of landfilled waste on the environment, climate and human health and circular waste management. Progress towards the general objective is measured against i) level of municipal waste disposed of in non-sanitary landfills in relation to the total amount of municipal waste generated (%), and ii) the degree of hazardous waste disposed of (%).

The NWMP also sets four specific objectives in support of the program's overall goals: 1) an improved municipal waste management system through increased recycling rate, reduced disposal of biodegradable waste in landfills and reduced disposal of waste in unsanitary landfills, 2) the establishment of a sustainable hazardous and industrial waste management system, 3) an increased rate of collection, reuse and recycling of special waste streams and more efficient use of resources, and 4) strengthened capacity of institutions in the field of waste management and regulations harmonized with EU acquis in the sector. Each specific objective is accompanied by several related measures that support the achievement of the specific objective; for example, one measure in support of the first objective on an improved municipal waste management system is the "extension of collection coverage to 100%" (RS 2022). In addition, the NWMP defines infrastructure needs and required economic instruments and financing schemes to support the achievement of goals. A more detailed overview on the specific objectives is provided in Appendix 1. An overview on required infrastructure needs is given in Appendix 2.

The NWMP not only states the goal of phasing out disposal in unsanitary landfills by 2034 but also sets recycling and preparing for re-use targets and targets for the reduction of disposal of biodegradable waste in landfills that will – if implemented – lead to a considerable improvement in the country's waste management practices until 2030. It should be noted however that the reduction of landfill disposal to a maximum of 10 percent of the total amount of municipal waste is only planned to be achieved by the end of 2049.

Given that EU member states must achieve this goal by 2035 (EU 2018), there is room for more ambitious target setting beyond 2030 to shorten the implementation periods, especially because EU policy in the waste sector is not static and considerably higher objectives regarding waste prevention, preparing for reuse and recycling are expected in the coming years.

The infrastructure required in NWMP for the establishment of a fully functional regional municipal waste management systems is divided into three phases. The first phase will focus on the establishment of waste collection and transfer systems, source separation, home composting, regional secondary separation facilities, and the development of sanitary landfills and phasing out of non-compliant disposal sites. The second phase will, apart from scaling up existing separation and composting initiatives, see the development of waste-to-energy plants , refused-derived fuel (RDF) and biological treatment facilities in larger cities. The third phase will include the closure and reclamation of unsanitary landfills and the increase of composting and recycling activities.

Given the ambitious and evolving recycling and re-use targets imposed by EU legislation and the long lifetimes of large-scale waste infrastructure, there is substantial risk that new waste treatment facilities that have been recently established or are planned for construction in the coming years could become obsolete or not comply with new policy objectives. This could have a substantial impact on their expected financial performance. In this regard, more detailed planning of necessary waste collection, separate collection, treatment and disposal infrastructure that adheres to long-term preparing for reuse and recycling targets seems necessary. The same can be said with regard to waste prevention program and initiatives.

2.2 Circular Economy and (Food) Waste Prevention Programs

Circular economy principles play an important role for the transition to a green economy. The Serbian government together with various development partners including UNDP and GIZ have contributed to the process to better understand and draft a roadmap towards circularity for the country. Serbia adopted the 2022 – 2024 Circular Economy Development Program, which defines priorities for the three-year period and lays the groundwork for the further development of a circular economy. One of the program's specific goals is to support businesses in removing waste from the supply chain, recycling materials and components, switching to renewable energy, and extending the lifespan of their products.

The capacity of local self-government (LSG) units in Serbia is as a prerequisite to facilitating a transition to a circular economy. In a survey for a study by GIZ (2019), 71.1 percent of respondents stated that they are more or less familiar with the circular economy concept, which is a good starting point for implementation of activities at the local level. This percentage was even higher in the group of cities with more than 100,000 inhabitants and amounted to 81.8 percent. A low level of awareness and lack or absence of financial instruments for circular economy activities were seen as the most significant barriers at the local level. When it comes to a strategic circular economy framework at the local level, only one third of LSGs had circular economy principles incorporated in their strategic documents.

Serbia has not developed or implemented a waste prevention program as required by Waste Framework Directive, although waste prevention is a stated goal of the overall waste management approach in the NWMP. Some partial legal requirements and policy measures have been established by various documents. The Law on Waste Management includes waste

management hierarchy which highlights waste prevention as priority. The Law also defines the content of local and regional plans which, among other things, define the obligation to develop waste prevention plans, inspection, implementation and updating of waste management plans and waste prevention programs. The Rulebook on the List of Waste Prevention Measures ("Official Gazette of RS", No. 7/2019) includes measures related to the waste generation, design, production and distribution phase and consumption and use phase of a product. Other than that, no specific goals or actions for waste prevention have been defined although the NWMP mentions economic instruments as a way to incentivize waste prevention and suggests a change of the waste management tariff system to support prevention by the introduction of a pay-as-you-throw system.

There are no specific measures related to the prevention of the occurrence or measures for the management of food waste in the current legislation. Over recent years, several studies have been published regarding the shift towards a circular economy with specific measures for the prevention and management of food waste (NALED 2019 & n.d., GIZ 2020, CEVES 2019). These and other measures have not been addressed in national legislation. In recent years however, numerous activities have been observed to promote the prevention of food waste, primarily funded by organizations involved in strengthening institutional capacity, raising public awareness, and supporting private-sector initiatives.

Despite legal and regulatory deficiencies, some promising food prevention projects have been implemented. For example, in partnership with UNDP Serbia and the City of Belgrade, the GIZ DKTI (German Climate Technology Initiative) established a voluntary scheme for food waste from the main generators in the city of Belgrade (retailers, restaurants, hotels, catering business, and public institutions like hospitals and kindergartens) to redistribute food surplus, which is still fit to human consumption, and enable easy access to food specially to vulnerable social groups. Other local level food waste prevention and redistribution initiatives exist as well. However, a large-scale implementation of waste prevention practices is only going to materialize through dedicated policies and legislation.

2.3 Local and Regional Waste Management Plans

The establishment of Waste Management Regions is prescribed by the Law on Waste Management which also includes the obligation to draft and update Regional Waste Management Plans. The Law on Waste Management defines the obligation to associate two or more LSG units with at least 250,000 residents and prescribes the mandatory content of the Regional Waste Management Plan (RWMP). After adoption by the assemblies of all participating LSG units in a given region, the RWMP is sent to the Ministry of Environmental Protection for approval. The implementation of the RWMP is the responsibility of LSGs and regionally established bodies. Thus far, regional waste management companies have been established in 13 regions, and another 12 regions have signed inter-municipal agreements, but regional companies have not been established yet. Some of the municipalities have joined other regions, different from those envisaged in the Strategy, while some regions have been merging. (RS 2022).

The Environmental Protection agency (under the Ministry of Environmental Protection) publishes all adopted RWMPs, listing 15 adopted plans, 5 completed but not adopted and a

further 8 not completed at the time of this report.[2] The Law on Waste Management sets fines for LSG units in case of delayed submission/adoption of RWMPs**.** The penalties for such offences are low, ranging between EUR 200 to EUR 400. In the past, LSG units that did not form waste management regions or delayed the establishment of common infrastructure were not sanctioned to remediate the situation.

As per the Law on Waste Management, LSG units have to adopt Local Waste Management Plans for their territories, even if RWMPs exist already. This points to the need to coordinate between the local and regional levels (and plans) in order to avoid redundancies and contradictions in the plans. Even though all LSG units have adopted local waste management plans, their implementation is largely voluntary. There were no recorded consequences for not fulfilling the obligations required by the Law on Waste Management and local waste management plans. A Handbook for the development of Local Waste Management Plans was developed by the Standing Conference of Towns and Municipalities (SCTM) as part of a capacity building program funded by the Government of Sweden.[3] There is currently no such guidebook for RWMPs.

2.4 Institutional Responsibilities at National Level

The Ministry of Environmental Protection (MEP) is the central authority in charge of all environmental affairs including waste management. In some cases, the Ministry transfers responsibilities to lower tiers of administration, such as the Autonomous Province of Vojvodina, regions and local administrations (cities and LSG units). MEP is responsible for:

- Drafting the Waste Management Strategy and National Waste Management Plan;
- Coordination of waste management activities of high importance for Serbia, and monitoring;
- Approving Regional Waste Management Plans, except for the Plans on the territory of the Autonomous Province of Vojvodina;
- Issuing permits, approvals, confirmations and other documents pursuant to the Law on Waste Management (Ministry issues permits to operators who are managing hazardous waste, treating inert and non-hazardous waste by incineration and treating waste in mobile facilities, other permits are issued by LSGs or the AP Vojvodina authorities);
- Maintaining records on permits, approvals, confirmations and other documents issued by other competent bodies;
- Monitoring and controlling of the implementation of measures for handling waste; and
- Undertaking other measures and activities pursuant to international contracts and agreements.

MEP oversees the implementation of the waste-related legislation such as the Law on Waste Management, and associated by-laws. The Environmental Inspectorate within the Ministry is

[2] List available here.

[3] The program "Support to Local Self-Governments in Serbia on the Road to the EU – Phase II". There is another ongoing support program (2022 – 2025) funded by the Government of Sweden, namely "Sustainable and inclusive services at the local level" with some focus on waste management and receiving strategic support of the Swedish Association of Local Authorities and Regions (SALAR).

responsible for enforcing environmental sanctions and inspecting the facilities for which the Ministry issues permits. The Ministry also entrusts inspection activities to other bodies at the regional or local level, namely the Autonomous Province of Vojvodina, cities, and municipalities (see chapter 2.6).

The **Serbian Agency for Environmental Protection** (SEPA) is responsible for:

- Keeping and updating records on waste management within the environmental protection information system;
- Managing publicly available waste market data, including data on secondary raw materials; and
- Reporting waste data, in conformance with international obligations.

In addition to MEP several other ministries have specific responsibilities related to particular waste streams:

- The Ministry for Agriculture, Forestry and Water Management is responsible for management of agricultural waste and by-products of animal origin;
- The Ministry for Mining and Energy has responsibilities for the management of mining waste;
- The Ministry of Health has responsibilities for the management of medical and pharmaceutical waste;
- the Ministry of Labour, Employment, Veteran and Social Policy undertakes occupational safety inspections on the entire territory of the Republic of Serbia, including in the waste management sector;
- the Ministry of Construction, Transport and Infrastructure inspects trucks, trains and ships.

In the Autonomous Province of Vojvodina, the key responsibility in the field of environmental protection lies with the Provincial Secretariat for Urbanism and Environmental Protection. The Provincial Secretariat participates in the development of the strategies and national waste management plans, performs waste management activities of importance for the province, approves regional waste management plans on its territory, issues permits, consents and other acts in accordance with the law, and supervises and controls the measures of waste management on its territory and other activities determined by law.

2.5 Responsibilities of LSG Units and Intermunicipal Cooperation

Municipal waste management is a core activity of local LSG units. According to the Law on Waste Management, LSG unit adopt local waste management plans and implement them, manage non-hazardous (including municipal) and inert waste on their territories, set service fees and tariffs, issue permits and other acts; supervise and control waste management measures, maintain records, and submit data on waste types and respective quantities to SEPA, in addition to other tasks determined by law. LSG units typically delegate their waste-related to public utility companies (PUCs), which are owned and managed by the LSG units and provide collection, transport, treatment and disposal services. LSG units can also organize waste management services through private-sector contractors.

LSG units are required to form or join waste management regions, which jointly provide waste management services. Regional structures are established through inter-municipal

cooperation agreements between LSG units, which define, among other issues, mutual rights and obligations regarding waste management facilities, operation of PUCs, and decisions making processes. The NWMP provides guidelines for the establishment of these regions, but the choice of which region to join remains the decision of each local government. The Law on Waste Management stipulates that a region must have at least 250,000 inhabitants. The purpose of this approach is to provide economies of scale for the development of more effective treatment technologies.

There are no special instruments or requirements on how to develop regional infrastructure and implement joint waste collection, waste recovery and disposal operations. This includes the absence of mechanisms to force individual LSG units to use available capacities for waste treatment and disposal. Choices such as the number and location of transfer stations, processing facilities, landfill locations and other parts of the system are left to members of each region to agree on internally. While adopted Regional Waste Management Plans (RMWP) are legally binding for members of a waste management region, there have been cases where LSG units have left one and joined another waste management region without any sanctions. Such approach creates large planning uncertainty and in general is jeopardizing efforts to establish regional treatment and disposal infrastructure.

2.6 Registration, Permitting and Control

The waste collection, transportation, treatment and disposal activities are subject to permit requirements. The Law on Waste Management defines and regulates requirements and procedures for issuing permits, supervision, and other relevant aspects of waste management. The Law on Integrated Prevention and Control of Environmental Pollution ("Official Gazette of RS", no. 135/04, 25/15 and 109/21) determines the conditions and procedure for issuing integrated permits for the operation of facilities and activities that may adversely affect human health, environment or material goods, types of activities and facilities, supervision and other relevant aspects of the prevention or control of environmental pollution. An integrated permit may be issued to single operator for performing several activities. In October 2021 137 collection permits, 178 transport permits, and 98 storage permits were issued for municipal solid waste activities (RS 2022).

Competences for issuing permits are divided between the national, provincial, and local level. The MEP, the Secretariat for Urban Planning and Environmental Protection of the Autonomous Province of Vojvodina, and LSG units are in charge of issuing permits in accordance with the Law on Waste Management, and supervising and controlling waste management measures, as well as other tasks determined by the Law. Operators of waste treatment, storage, reuse and disposal facilities submit an application for a permit to the competent authority. The MEP defines the application form for the issuance of a permit. Permits for treatment, storage, reuse and disposal of waste are issued for a period of ten years.

The MEP supervises the work of SEPA, the Autonomous Province, LSG units, as well as authorized legal entities, in performing the entrusted tasks. The control activities are performed by the inspectors for environmental protection. The Autonomous Province is entrusted with the inspection supervision over waste management activities that are entirely performed on its territory and the operation of waste management facilities for which the competent authority of the Autonomous Province issues a permit. Cities and municipalities

are also entrusted with inspection supervision over activities of collection, transport, treatment, storage, reuse, and disposal of inert and non-hazardous waste, for which they have issued a permit.

2.7 Documentation, Reporting and Data Management

The Law on Waste Management defines and regulates reporting requirements and procedures. Legal entities producing and/or managing waste, including those who place packaging and other products on the market that become special waste streams have an obligation to submit annual reports. Depending on the type of operation, such reports contain data on the type, quantity, origin, characterization and classification, composition, storage, transport, import, export, treatment, recovery and disposal of generated waste. Landfill operators are obliged to keep daily records on received and disposed quantities of waste and to report to SEPA on an annual basis. Manufacturer and importer of products are also required to provide annual reports on the quantity and type of products that become special waste streams.

SEPA, tasked with collating and reporting information, has been faced with significant inaccuracy and incompleteness of waste quantities and composition data, especially concerning municipal waste data, which are submitted by LSG units or their respective PUCs. In 2020, 102 municipal reports were submitted, representing only around 59 percent of all LSG units in Serbia. Due to the lack of reporting from the remainder of LSG units, a significant portion of national-level waste data are calculated at expert level and based on pilot assessments in the country. This may also be the reason for reported fluctuations in waste generation over the last decade (see chapter 3). In addition, the institutions involved in data collection and reporting have not implemented a specific verification process, thereby exacerbating data inaccuracies.

2.8 Communication and Public Awareness

Responsibilities for raising public awareness and providing information to citizens are shared between several institutions. Competent institutions for implementation of information campaigns are the MEP, relevant bodies of the Autonomous Province of Vojvodina, and LSG units. Implementing partners include the Ministry of Education, Science and Technological Development, the Ministry of Health, the Ministry of Trade, Tourism and Telecommunications, the Serbian Chamber of Commerce and various civil society organizations. Extended producer responsibility schemes currently do not play a major role in promoting sustainable production and consumption and increasing awareness and citizens' participation in separate collection schemes for specific waste streams.

Several information and awareness raising campaigns have been organized in recent years but a broader communication strategy has not been developed and implemented. Such communication strategy could focus on waste prevention, reduced littering, support for separate collection and recycling, and the promotion of home composting. The communication strategy could also raise public awareness on the importance of waste management fees to enable sustainable service provision. Examples of successfully completed awareness raising campaigns include:

- ***Don't pollute. No excuses!*** This public campaign was developed and promoted by the Serbia Broadband Foundation. The main aim was to raise awareness about pollution

and waste disposal and promote good practices. The core concept of the campaign develops around the idea of responsibility for future generations.

- ***Trash Challenge Serbia / Anyone Can Be a Hero***. This campaign promoted activism and invited citizens, communities, and companies to take environmental protection actions. It was organized in cooperation between company *Ekostar Pak* and NGO *Trash Hero Belgrade*. The initiative took place in Belgrade, and more than 30 locations in Serbia in 2019, with relevant partners such as the MEP and the EU delegation in Serbia, along with Mikser Festival, Trash Hero, Avala Green, and others.

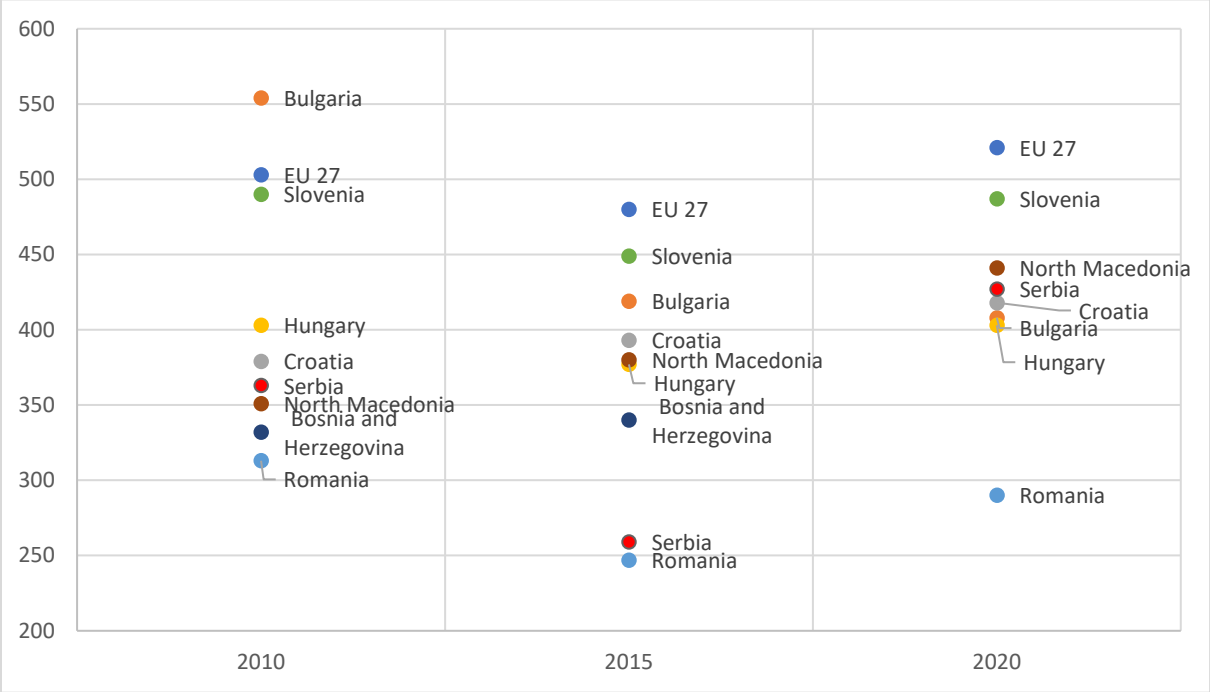
The NWMP recognizes the importance of information campaigns and awareness raising, and envisions stakeholder engagement as part of the planned waste infrastructure projects. Especially for source separation and home-composting projects, the NWMP anticipates campaigns that "are planned for a period of 15 months - three months before the system is put into operation and twelve months after that. Typical activities include setting up an information team at a waste management institution, preparing a campaign, polling, preparing information material, organizing trainings and events, reviewing progress, and adapting the approach."

3 Overview of Municipal Waste Management System

3.1 Municipal Waste Quantities and Composition

In 2020, 2.95 million tons of municipal waste[4] were generated in the Republic of Serbia, an increase of around 11 percent since 2010 (Eurostat 2023). This corresponds to 427 kilogram of waste per capita and year, which is 18 percent below the EU-27 average and comparable to neighboring countries in southeastern and central Europe (Figure 1).

Figure 1: Municipal waste generation in kg per capita and year for selected countries, 2010 - 2020

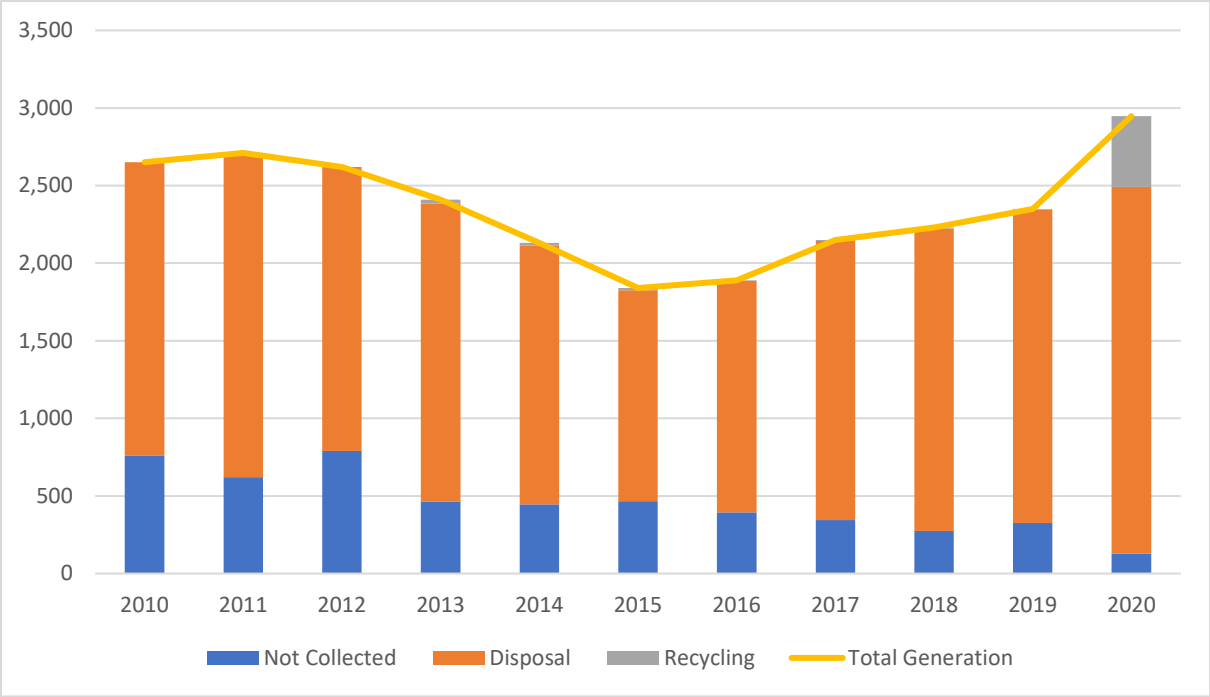


Source: Eurostat 2023.

As shown in Figure 2, of the 2.95 million tonnes of municipal waste generated, more than 4 percent (0.13 million) remained uncollected, 15.4 percent (0.46 million) were recycled, and 80 percent (2.37 million) were landfilled (Eurostat).

[4] In line with the amendments to the EU Waste Framework Directive and the proposed amendments to the Law on Waste Management, municipal waste is defined as separately collected household waste, including paper and cardboard, glass, metal, plastic, biowaste, wood, textiles, packaging, waste electrical and electronic equipment, waste batteries and accumulators, bulky waste and mixed municipal waste and/or separately collected waste from other sources, if such waste is similar in nature and composition to household waste.

Figure 2: Municipal waste generation and treatment in thousand tons in Serbia, 2010-2020

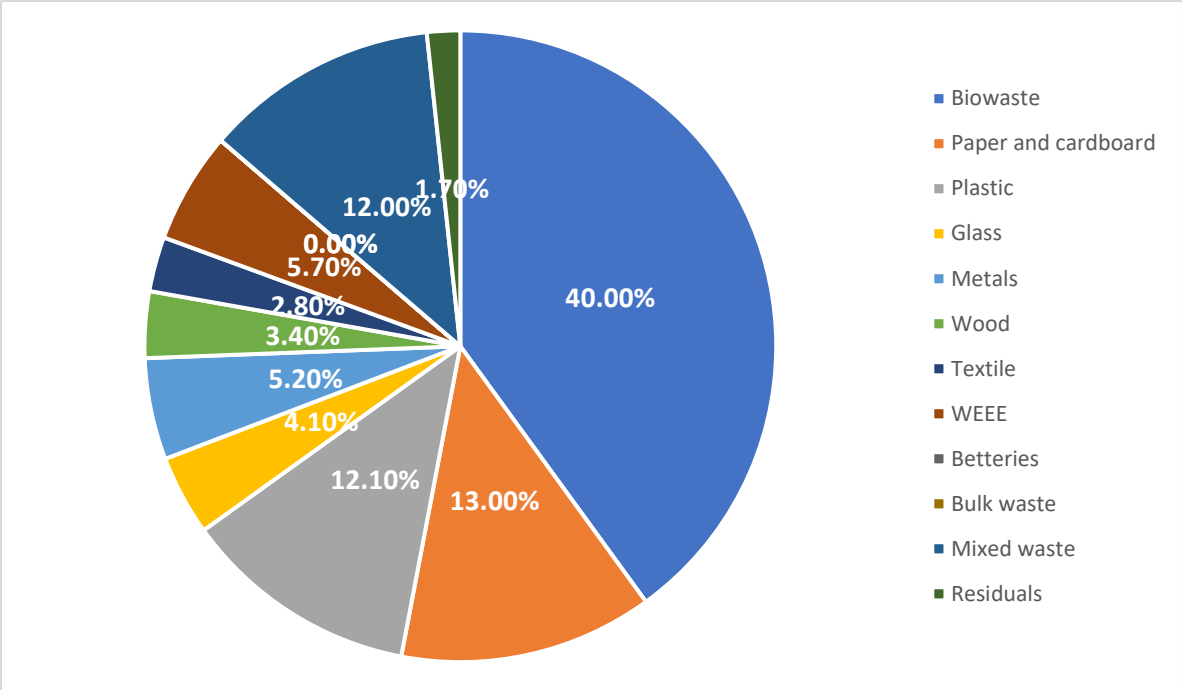


Source: Eurostat 2023

Two issues stand out in Figure 2; i) a sharp increase in the recycling rate combined with an improvement of collection efficiency in 2020 compared to the years before, and ii) a significant reduction of total municipal waste generation during the middle 2010s. While the former can be attributed to a new calculation methodology in line with EU requirements (SEPA 2022), the reason for the fluctuation in waste generation points towards waste data reporting and analysis challenges in Serbia mentioned in chapter 2.7.

The reported composition of municipal waste in 2020 shows that biowaste, which consists of garden waste and food waste, has the highest share at 40 percent, (Figure 3**).** Recyclable waste components from the dry fraction are plastics (12.1 percent), paper and cardboard (13 percent), glass (4.1 percent) and metals (5.2 percent). Other reported waste categories include wood, textiles, bulky waste, batteries and other waste.

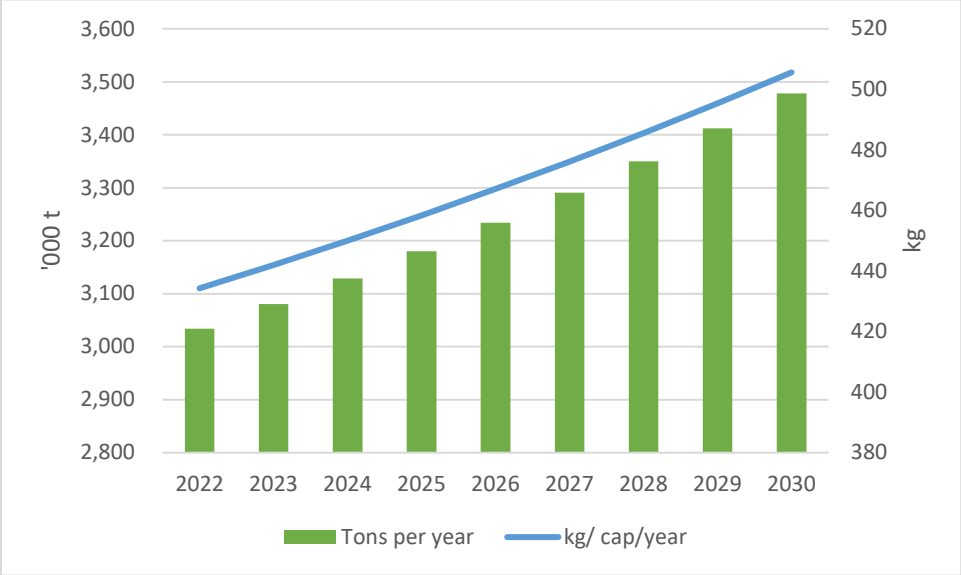
Figure 3: Composition of municipal waste in 2020



Source: RS 2022.

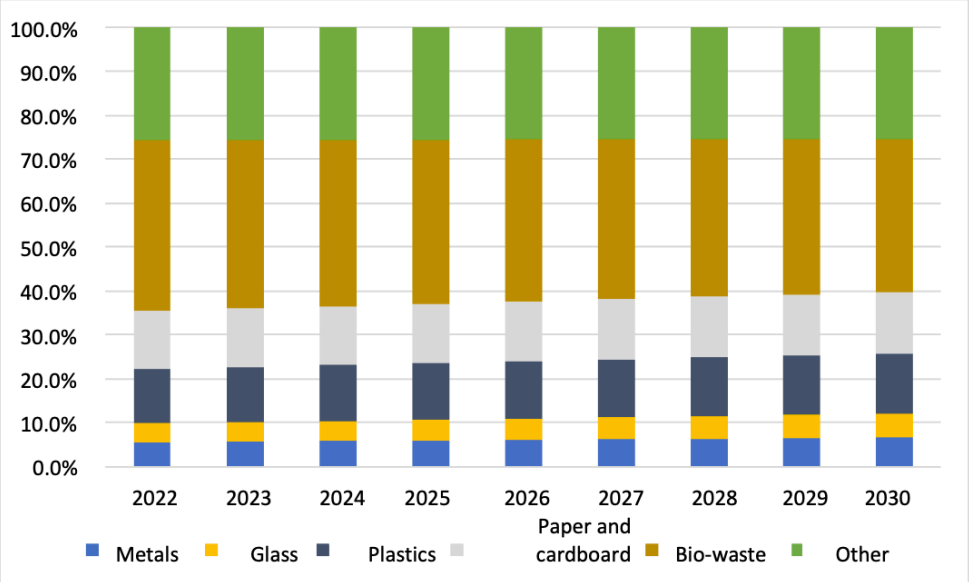
Based on population projections and Serbia's economic outlook, the Waste Management Plan 2022 – 2030 expects an annual municipal waste generation per capita of 505 kg and 3.5 million tons in 2030, an increase of 16.4 percent and 14.6 percent, respectively, compared to 2022 (Figure 4**).** During the same period, the biowaste fraction (food and garden waste) in the municipal waste stream is expected to decrease to 34.7 percent, while the share of other fractions is expected to increase; paper and cardboard to 14 percent, plastics 13.8 percent, glass to 5.3 percent and metals to 6.7 percent, while all other waste categories together are expected to have a share of 25.5 percent (Figure 5).

Figure 4: Projected amounts of generated municipal waste for Serbia from 2022 - 2030



Source: RS 2022.

Figure 5: Projected composition of generated waste for Serbia from 2022 to 2030 (%)



Source: RS 2022.

While the share of biowaste (food and garden waste) is expected to decrease until 2030, total generation of *biodegradable* waste – including biowaste, green waste from parks and public spaces, and parts of the paper and cardboard and mixed fractions – is projected to increase by around 8 percent between 2022 and 2030. The generation of packaging waste is expected to increase by almost 37 percent during the same period**.** The projected increase, especially in packaging waste, means that EU targets for landfill diversion and recycling of packaging materials will be more challenging, putting additional pressure on the Serbian Government and its national and subnational institutions to improve Serbia's waste management systems.

3.2 Waste Collection

3.2.1 Residual Waste Collection

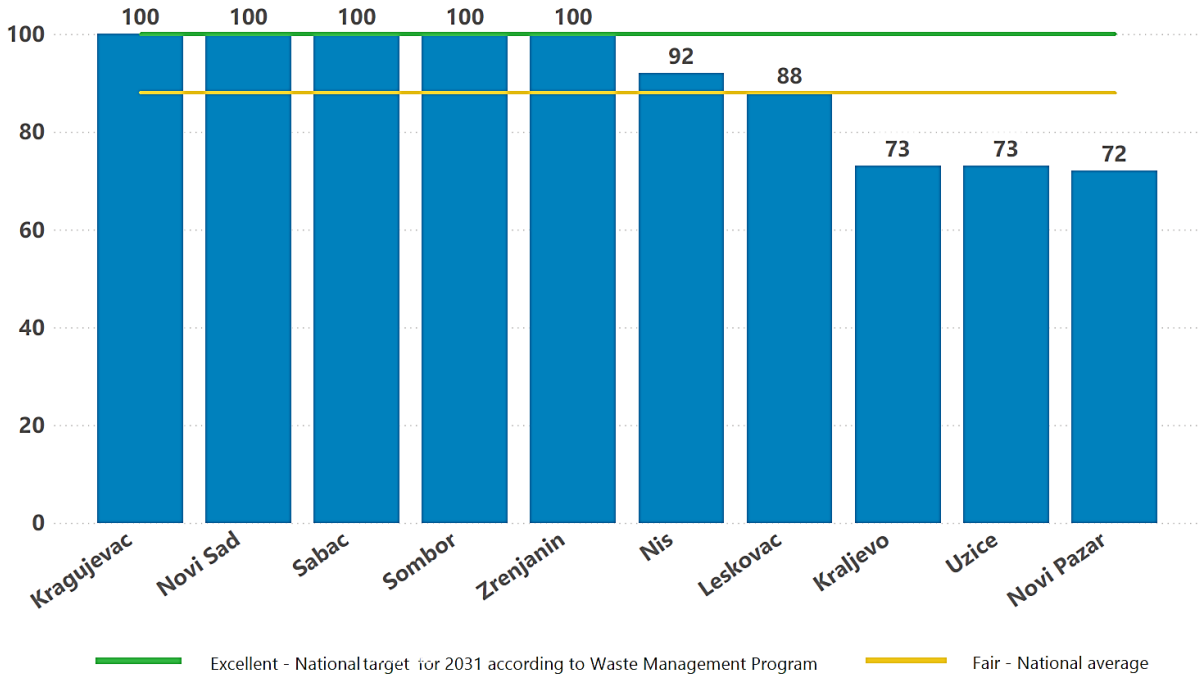
In 2020, 2.83 million tons of municipal waste were collected and landfilled or recycled, the latter mostly through packaging waste management systems ("collective schemes"). This means that more than 4 percent (0.13 million) remained uncollected. The figure for uncollected waste seems low, considering that SEPA (2022) states an average collection system coverage of only 86.4 percent, which can probably be attributed to data reporting and analysis challenges.

In urban areas waste is usually collected twice a week or more, while in rural areas and in areas where each household has its own waste bin, the most common collection frequency is once a week. In urban areas, standard 1.1 m^3 euro containers with wheels are most commonly used for municipal waste, while in some cases larger volume stationary containers are used. There is a growing trend of setting up underground containers (3-5m^3) in urban areas. In semi-urban areas, 120-liter or 240-liter bins per household are most often used, while in rural areas, waste is collected from households in plastic bags or bins ranging from 80 to 240 liters in capacity. Various types of special vehicles are used for waste collection, such as

waste collection vehicles with different compaction technologies, tipper trucks for open type containers, ordinary trucks and tractors with trailers.

Although waste collection services in Serbia are on a rather high level overall, services vary significantly between LSG units and their PUCs that carry municipal waste collection and disposal services. Out of 10 cities that were assessed in preparation of this report, half reported 100 percent collection (Kragujevac, Novi Sad, Šabac, Sombor and Zrenjanin), while Niš and Leskovac collect less than 100 percent but more than the national average of 86.4 percent. Kraljevo, Užice and Novi Pazar reported a collection coverage of more than 70 percent of waste (Figure 6). One of the barriers to full collection is lack of equipment: six out of ten cities (Novi Sad, Zrenjanin, Niš, Kraljevo, Užice and Novi Pazar) reported a lack of containers and vehicles.

Figure 6: Percentage of city population with regular solid waste collection (%)



Source: Own survey.

Even the smallest LSG units with around 10.000 inhabitants have their own PUC with limited financial resources, which creates inefficiencies and is a major contributing factor to the state of the sector. PUCs often base the planning and operation of collection and transport services on insufficient evidence, rather than on sound analysis based on population growth, frequency of filling and emptying of containers/bins, and the capacity of vehicles. The lack of technical and financial capacity in PUCs can be exacerbated by corporate governance issues.

The move from local waste management systems organized at municipal level to regional waste treatment and disposal facilities will have a significant impact on the organization of waste collection and transportation due to increased transport distances. Replacement of significant parts of vehicle fleets will be required due to both technical and financial considerations. Such investments will be problematic for small LSG units, especially if they are located at larger distances from regional treatment facilities. Regionalization will also

influence the roles and responsibilities of local PUCs; currently, there are PUCs supporting new regional waste management systems by collecting waste in the boundaries of their respective LSG units, and transferring it to the regional landfill/treatment facility. In other waste management regions, private operator have been tasked with collection activities in addition to operating landfill/treatment facilities.

3.2.2 Separate Waste Collection

According to the NWMP, around 482,000 tons of municipal solid waste were collected separately in 2020. Of this, around 47 percent (226,000 tons per year) can be attributed to separately collected packaging waste through Serbia's "collective schemes" (see chapter 3.3). The majority of separately collected packaging waste is from industrial and commercial origin or results from informal sector activities. While legislation requires the separation of plastic, paper, glass and metal in specially marked containers, only a limited set of LSG units have established waste collection centers ("recycling yards") or implemented separate household collection using a two-bin system for recyclables and residual waste. It is unclear what waste fractions are separately collected and how the separate collection for the waste outside of the collective EPR schemes is carried out since according to NWMP there is little organized separate collection, sorting and recycling of municipal solid waste in Serbia.

A constraint for developing separate collection of municipal waste is the lack of clarity around the responsibilities of stakeholders involved. While LSG units are in principle responsible for organizing separate waste collection on their territory, the separate collection of main recyclable waste commodities in municipal waste, like paper and cardboard, plastics, glass and metals is supposed to be implemented and financed mainly through extended producer responsibility systems for packaging waste (see chapter 3.3).

Currently, the informal sector plays a key role in recycling in the country. Out of the total amount of packaging waste collected for recycling, as much as 87 percent originates from the informal sector and commercial/industrial sources, while only 13 percent is collected by PUCs, or the packaging schemes directly (EEA 2021). GIZ (2018) estimates that in Serbia "between 6,000 and 10,000 families, or 35,000 – 55,000 persons are working as full-time collectors who earn (close to) 100 percent of family income from collecting." In addition, there is a large number of persons that engage in part-time picking or alternate it with other economic activities.

The informal sector collects a variety of materials with waste pickers often specializing in specific recyclables. Valuable materials are extracted from PUC containers, dump sites, yards, and public areas. Collected materials include paper, metals, glass and plastic bottles, food waste, discarded housewares, clothing, shoes, tools, and anything that can be sold to a second-hand market or to recycling businesses in the value chain. Transactions between the informal collectors and (semi-) formal buyers are often not properly recorded, thereby adding to the data collection and reporting challenges in Serbia's solid waste sector.

Despite the efforts made by some LSG units, the collective EPR schemes, and the informal sector, the overall low rate of separate collection presents a challenge for increasing Serbia's recycling rate. The four main recyclable municipal solid waste fractions (metals, glass, plastics, paper and cardboard) amounted to more than 1 million tons in 2020, but only slightly more than 300,000 tons were collected separately. Accordingly, the NWMP emphasizes the need to establish adequate primary separation systems through the roll-out of a two-bin system

initially and a system with additional bins, for example for glass or organics, in a second phase across Serbia. The improvement of Serbia's extended producer responsibility system (chapter 3.3) for packaging waste is another crucial factor for increasing separate collection and recycling rates.

3.3 Extended Producer Responsibility for Packaging and Packaging Waste

The management of packaging waste in Serbia is based on the extended producer responsibility (EPR) principle and regulated by the Law on Packaging and Packaging Waste (LPPW). According to LPPW, each company that places more than 1 ton of packaging on the market within the Republic of Serbia is obliged to meet the national targets defined by the MEP. The obliged companies can achieve their responsibilities (i) by transferring their obligations to an authorized operator – producer responsibility organization; (ii) independently managing packaging waste (with a valid permit) or (iii) paying state compensation according to the Law on Fees for the Use of Public Goods. The recycling and recovery targets for packaging waste are comparable to these in EU countries (see chapter 2.1).

In 2020, 362,236 tons of packaging were placed on the market of the Republic of Serbia (Table 1**)**. The major share of packaging placed on the market belongs to paper and cardboard (34 percent), followed by plastics (25 percent), wood (21 percent), glass (14 percent), metal (5 percent) and others (less than 1 percent). The quantities of packaging remained relatively stable over the last years, which is in contrast with the increased quantities of municipal waste. The quantities of packaging seem to be considerably underestimated in comparison with municipal waste quantities generated and data from other countries.

Table 1: Quantities of packaging placed on the Serbian market (tons)

Material	2017	2018	2019	2020
Plastic	94,098	92,765	92,807	91,265
Glass	56,766	55,430	62,009	52,324
Metal	14,599	15,682	16,956	17,948
Paper and cardboard	113,889	117,298	122,034	122,660
Wood	77,805	77,092	76,971	77,366
Other	762	688	752	673
TOTAL (t)	357,919	358,955	371,529	362,236

Source: RS 2022.

At present, seven operators ("collective schemes") hold a permit to establish EPR system for packaging waste. In 2020, out of the 362,236.7 tons of packaging placed on the market, almost all was reported by legal entities or entrepreneurs who transferred their obligations to the collective schemes. The amount of recovered packaging waste was 226,020.8 t, of which almost 96 percent was recycled. The quantities for recovered and recycled packaging waste

in 2020 by each operator are presented in Table 2. Based on the available data, the general and specific national targets in 2020 have been met, namely for the recovery of packaging waste (62.6 percent) and for the recycling of waste (60 percent) compared to the quantities of packaging placed on the market.

Table 2: Total amount of recovered and recycled packaging waste by the operator in 2020 (tons)

Operator	Amount of recovered packaging waste (tons)	The amount of recycled packaging waste (tons)
Sekopak	96,872.7	89,791.9
Ekostar Pak	75,956.5	75,956.5
Delta Pak	10,892.9	10,892.9
Ceneks	17,692.7	16,334.3
Tehno Eko Pak	13,729.6	12,859.2
Ekopak Sistem	6,895.2	6,895.2
Uni Eko Pak	3,981.2	3,981.2
Total (t)	226,020.8	216,711.2

Source: RS 2022.

Despite the declared achievement of recovery and recycling targets for packaging waste, there is considerable room for improvement:

Firstly, packaging waste management relies mostly on the collection and recycling of industrial and commercial packaging, as well as on quantities collected from the informal sector. The system of separate packaging waste collection from households is currently not adequately established (see chapter 4.2), and most of the packaging waste from households is disposed as mixed municipal waste. Municipal packaging waste reported as collected through collective schemes in 2020 was 54,151 tons (SEPA 2022), which is only about 22.5 percent of the estimated amount of packaging waste (ca. 240,000 tons per year) in the mixed municipal waste stream (RS 2022). Accordingly, the NWMP emphasizes the need to focus the efforts on separate collection of packaging waste from households.

In addition, the reported quantities of packaging placed on the Serbian market seem low, given that packaging accounts for around 38 percent of municipal solid waste in the EU on average. Even when considering the high content of biowaste in Serbia's municipal waste, the quantities of declared packaging placed on the market seem understated, amounting to only around 12.5 percent of municipal solid waste generation. This also suggests that recycling and recovery targets are artificially reduced, leading to a lack of incentives for state entities, collective schemes and manufacturers/producers to participate in the country's EPR scheme and invest in the development of more extensive and efficient separate collection system for packaging waste from households.

Considering that extended producer responsibility schemes for packaging have been introduced in 2009 through the Law on Packaging and Packaging Waste, the results achieved

in the development of separate collection schemes, sorting and recycling infrastructure are not satisfactory. There are obvious deficiencies in the requirements for the operation of EPR schemes and reporting procedures, lack of clear responsibilities for the development of separate waste collection schemes with national coverage, limited financial resources generated through EPR due to insufficient economies of scale and a lack of adequate coordination, control and enforcement.

3.4 Waste Treatment

3.4.1 Sorting Installations for Separately Collected Recyclable Waste

At present, the waste management sector in Serbia is not sufficiently developed to process recyclable waste commodities at scale. Recently, sorting lines for separately collected waste have started operating in several LSG units/regions (Table 3) such as Belgrade, Sremska Mitrovica, Pirot and Uzice. Some of them were constructed recently, while others were used for mixed waste sorting, and modified operations after implementation of separate waste collection in the waste management region. Operators in charge of waste sorting in cooperation with LSG units define the gate fee for sorting of waste. Usually, gate fees are not charged for high quality recyclable fractions. The extended producer responsibility schemes practically do not provide support for the development of sorting infrastructure operated by PUCs. The producer responsibility organizations (PROs) do not guarantee the full costs recovery for separate collection and sorting activities implemented by PUCs. The financial contribution paid by PROs to PUCs for part of the separated waste designated for recycling is small and does not provide incentives for local authorities/PUCs to implement and develop separate collection schemes on their territory. There are no glass sorting/treatment facilities in the country, which could be a barrier for the achievement of glass recycling targets. The majority of companies dealing with secondary raw materials are of small scale, with limited technical capacity and financial resources.

Table 3: Sorting facilities for separately collected recyclable waste in Serbia

	Name	**Location**	**Operator**	**Type of plant**	**Annual capacity (input waste)**	**Year constructed**
Subotica	Regional landfill Subotica	Bikovo	Regional landfill Subotica LLC	MRF	70,000 tons per year	2019
Užice	Regional center Duboko	Užice	PUC Duboko Užice	MRF	17,000 tons treated in 2020	2014
Sremska Mitrovica	PUC Regional Landfill Srem-Mačva	Sremska Mitrovica	PUC Regional landfill Srem-Mačva	MRF	Projected* 15t/h	2022

	Name	Location	Operator	Type of plant	Annual capacity (input waste)	Year constructed
Novi Sad	PUC Cistoca Novi Sad	Novi Sad	PUC Čistoća	MRF	15,000 tons per year	2002
Pirot	PUC Regional landfill Pirot	Pirot	PUC Regional landfill Pirot	MRF	Projected* 3t/h	2022
Jagodina	Regional landfill Gigos	Jagodina	Porr Werner Weber (PWW)	MRF	15,000 tons per year	2010
Belgrade	Plant Otpad	Ada Huja	PUC Gradska cistoca	MRF	5,000 tons per year	2013
Kruševac	Srnje Landfill	Srnje	PUC Krusevac	MRF	829 tons per year	2012
Leskovac	Regional landfill Željkovac	Leskovac	Porr Werner Weber (PWW)	MRF	68,500 tons per year	2009

Source: Based on RS 2022.
***Note**: Both MRFs are awaiting permits and have not yet started operations.

Due to the small size of the market and limited investment capacities of the companies, low cost and productivity equipment is used for sorting and compaction of waste. Recyclable waste is usually sorted using sorting lines comprising of conveyors and sorting cabins. In some cases, vertical balers with low compression force (e.g. 15 tons) are used and the bales produced are of small size and weight of around 100 - 150 kg for paper and cardboard. In principle, such equipment is rarely used by specialized waste management companies in other European countries and mostly applied in office buildings and shops for the compaction of paper and carboard and transportation to small distances. Large sorting facilities are usually equipped with automated horizontal channel presses with large productivity and automated feeding of material and strapping the bales. Such equipment is producing larger size bales with much higher degree of compaction, usually 450 – 600 kg/bale. The higher degree of compaction allows for optimization of transport costs and requires less storage capacities.

3.4.2 Management of Biowaste

Currently, separate collection and treatment of biowaste is rare in Serbia. The only cities with organized collection and composting of green waste from public areas are Novi Sad and

Subotica, which also run the only two formal composting facilities operating in Serbia at the moment. The Novi Sad composting facility is operated by the city's PUC and has a capacity of 5,000 tons per year. The composting facility in Subotica is located at the regional waste management center and operated by the regional waste management company. It processes 20,000 tons per year of public green waste and sludge from the local wastewater treatment plant. In addition, project documentation is currently finalized for the regions of Pirot and Uzice and the construction of composting facilities is planned in near future. Most other LSG units only collect green waste and dispose of it on landfills without any treatment. There is no formal or legally organized collection of other biowaste streams. However, home composting is already a common practice, at least in in rural and semi-urban areas. Some municipalities, such as the Bački Petrovac (part of Novi Sad waste management region) and the cities of Pančevo and Užice, are also piloting home composting projects.

The Republic of Serbia plans to develop the necessary infrastructure and systems to reduce the disposal of biodegradable waste in landfills. According to NWMP, the target value is to reduce the disposal of biodegradable waste in landfills by 2028, to 75 percent of the total amount of biodegradable waste generated in 2008, to 50 percent by the end of 2032 and to 35 percent by the end of 2039. Notwithstanding the considerably more ambitious timeline for EU member states concerning the diversion of biodegradable waste from landfill, these targets are challenging and will require a combination of waste reduction measures, a high degree of primary separation and waste treatment, and home composting. The implementation of these measure will also be crucial for moving towards the new recycling and preparation for re-use targets defined in the 2018 Waste Framework Directive (see chapter 3.1).

Despite the above-mentioned goals, there are no specific objectives for the separate collection of biowaste from households for the implementation period of the NWMP. While the NWMP does mention the introduction of separate collection of green waste during the first implementation phase of the plan, the separate collection of biodegradable waste in all waste management regions could only be fully implemented by 2039. The NWMP also stays quiet on developing legal requirements or standards defining compost quality and establishing compost certification schemes, which are important prerequisites for establishing a functioning market for compost.

Under the first implementation phase of the NWMP, home composting and local composting facilities are planned. Home composting will focus on rural and semi-urban areas with the goal of composting 30 percent of produced biodegradable in designated waste management regions by 2028. Open composting facilities are envisioned at the local level to utilize separately collected green/garden waste from households (areas with family houses) and public green areas. Municipalities will need to decide whether to apply a centralized or decentralized composting model. Generally speaking, LSG units in Serbia are large enough to independently organize composting services.

The NWMP also plans the development of more centralized biological treatment plants. Such plants, either closed composting systems or anaerobic digestion (AD) facilities, can be more appropriate in an urban context, are able to deal with larger amounts of separately collected food waste (biowaste) from households, the commercial sector and the food industry. In some cases treatment of bio-waste with municipal origin can be combined with other waste streams such as sludges from wastewater treatment plants or animal manure.

According to the NWMP, treatment plants for separately collected biowaste with a total capacity of 380,000 tons per year are planned by 2034. Implementation will heavily depend on the successful source separation of biowaste and the introduction of full-cost recovery, preferably based on pay-as-you-throw charging systems and additional financial instruments to make separate collection and subsequent treatment the preferrable option. The investment in AD capacities could also be supported by preferential electricity prices for biogas power plants.

3.4.3 Treatment of Mixed Municipal Waste

At present the majority of collected municipal waste is disposed to landfills without preliminary treatment. The only existing large-scale facility for the treatment of mixed municipal solid waste is the waste-to-energy (WtE) plant at Vinča landfill in Serbia's capital Belgrade. The plant has an input capacity of 340,000 tons per year, installed production capacity of 25 MW and thermal power production of 56 MW, and is expected to commence commercial operation in the summer of 2023. Two further thermal treatment plants are planned in Nis and Kragujevac under the Clean Serbia project implemented by the Ministry of Construction, Infrastructure, and Transportation and financed from a Chinese loan. The facilities in Belgrade, Nis and Kragujevac are mentioned in the NWMP as part of the planned infrastructure development. There are also reports that by the end of 2024, Elixir, a Serbian fertilizer producer, plans to build an WtE plant in the industrial-chemical complex in Prahovo, which would be supplied with waste from households in eastern Serbia, but would also use non-hazardous waste from commercial and industrial sources from other parts of the country (Balkan Green Energy News 2022).

The latest revisions in EU waste management legislation could have impact on the operation of incineration plants in the long-term. While energy-from-waste contributes towards achieving landfill diversion targets, the mass incineration of mixed municipal waste can present a barrier for the achievement of Serbia's recycling targets. The achievement of recycling objectives implies a significant increase in source separation and separate collection, which will result in a significant drop in residual waste quantities and a reduced heating value of residual waste. This could put the long-term technical and financial viability of waste incineration plants into question and may lead to such plants being converted to RDF incineration facilities in the long term. Any plans for new incineration facilities beyond those mentioned in the NWMP should be carefully considered.

Similarly, the development of large capacity plants for mechanical-biological treatment (MBT) should be carefully assessed. The NWMP identifies facilities for the production of recycling materials, compost and RDF as an infrastructure need for the second phase of the NWMP; three RDF plants with municipal waste as input and an average capacity of 75,000 tons per year are envisaged. As from 2027 however, the compost-like output produced from MBT installations for residual/mixed municipal waste will no longer be counted towards the achievement of recycling targets in the EU. Any feasibility assessment for the construction of large-scale MBT plants should take this constraint into consideration.

3.5 Recycling and RDF Processing Capacity

Two cement plants in Serbia - Lafarge Serbia (Beocin) and CRH Serbia (Novi Popovac) - have permits for the thermal treatment (co-incineration) of certain high-calorific fractions of municipal waste and other special waste streams in cement kilns. A third company, Titan

Cementara Kosjerić, has recently applied for a permit for co-incineration of RDF. In addition, the cement industry uses more than 300,000 tonnes of non-hazardous and hazardous industrial waste per year (mostly fly ash and granulated blast furnace slag) in their production processes. At the moment, there are no thermal power plants receiving RDF. An increase in RDF production (see above) could change that.

The development of recycling industry in Serbia depends on the different recyclable waste commodities. Separately collected paper and cardboard waste are effectively recycled in the country, with about 85,000 tons annually processed by companies from Kappa Star group (EU Accession Conference 2020). Glass recycling is still uncommon in Serbia with only one company ("Srpska fabrika za reciklazu") currently operational. Metals, both ferrous and nonferrous, are recycled efficiently through a vast network of collectors and metal traders. The steel waste collected is processed by several steel companies. There are several plastics processors in Serbia that process both collected PET and non-PET. Although there is PET bottles production in the country, the recycled content is small and PET waste collected is mostly sorted, washed, baled and then recycled into flakes, which are exported.

3.6 Landfilling of Municipal Waste

Of the 2.37 million tons of municipal solid waste reported as landfilled in 2020, only around 560,000 tons were disposed of at regional sanitary landfills with the remainder being sent to non-compliant landfills and dump sites. So far, 12 sanitary landfills have been constructed in Serbia, out of which ten are regional facilities built to serve multiple municipalities. Regional landfills are managed through public-private partnerships, PUCs, and publicly owned limited liability companies. Three regional sanitary landfills (Kikinda, Lapovo and Leskovac) are licensed to receive certain types of hazardous waste, and have separate cells for waste containing asbestos, other hazardous construction and demolition waste and solidified hazardous waste. Table 4 shows the amount of waste disposed of at the 12 sanitary landfills for the period 2017 to 2021. Some RSL sites recorded rather large fluctuations in waste disposed over the years, which cannot be solely explained by changes in waste generation but can be attributed to municipalities/PUCs disposing waste in their own, non-compliant landfills in order to avoid disposal fees.

Table 4: List of compliant municipal waste landfills in Serbia and amount of waste disposed (tons)

Sanitary Landfill	2017	2018	2019	2020	2021
RSL Duboko, Užice	75,295	79,764	82,214	83,541	87,905
RSL Vrbak, Lapovo	41,266	35,264	68,166	57,396	50,404
RSL Kikinda	50,411	55,056	50,231	37,478	29,717
RSL Gigoš, Jagodina	62,893	61,660	75,360	69,042	75,835
RSL Željkovac - D2, Leskovac	69,255	71,102	71,369	82,953	77,388
RSL Muntina padina, Pirot	29,987	28,456	30,903	30,654	33,918
RSL Jarak, Sremska Mitrovica	50,912	51,080	55,369	56,680	58,574

RSL Pančevo	25,815	25,358	28,562	76,225	41,817
RSL Subotica	/	/	4,056	27,382	27,978
Local landfill Meteris, Vranje	16,841	17,247	20,087	21,946	23,504
Local landfill Vujan, Gornji Milanovac	15,203	14,655	14,580	15,361	15,095
RSL, Vinca	Started accepting waste in 2021				327,980
Total (t)	437,878	439,642	500,897	558,568	850,115

Source: SEPA, 2022.
Note: RSL = Regional Sanitary Landfill

There are no landfill taxes applied in Serbia and gate fee amounts are set by LSG units and vary between municipalities. Generally, observed gate fees were between €20 to €25 per ton of deposited waste. There are currently no mechanisms in place for achieving full cost recovery of ongoing operations and future costs for landfill closure and aftercare are not accounted for either.

In addition to regional sanitary landfills, there are 135 municipal landfills that do not comply with environmental standards and that accept municipal waste that is collected in an organized manner. There are also still 2,656 illegal dumps, often in rural areas, which are beyond the control of municipal utility companies. About 20 percent of the generated municipal waste in the Republic of Serbia is dumped in illegal dumps. These dumpsites vary in size and are a consequence of the lack of waste management funds and insufficient waste management organizations at the local level. Exact data gathering on dumpsites seems to be challenging. SEPA (2022) reported that out of 174 LSG units, 144 responded in an annual survey for the report *Waste Management in Republic of Serbia* (2021 report: 88 LSG units responded). While the response rate has increased considerably, it is concerning that 30 LSG units did not respond, given that phasing out illegal dumping will rely heavily on the corporation and compliance of LSG units.

The NWMP stresses the importance of improving the landfilling of waste. It states as goals the development of regional sanitary landfills in each waste management region in Serbia during a first phase, the closure of all unsanitary landfills and dumps by 2034, and the eventual reclamation of closed landfills and dumps. The NWMP estimates that around €310 million of investments will be required for achieving these goals. Similar to other described infrastructure measures, the long-term financing of the system will rely on full-cost recovery and the introduction of appropriate tariffs and economic instruments.

4 Financing of Waste Management Services

4.1 Infrastructure Investment Needs in the NWMP

As described in chapter 3.1, the NWMP identifies infrastructure investments that will be implemented in three phases. The Program provides an estimate of implementation costs for two phases however: for the years 2022 to 2049, the period for implementing all planned EU harmonization measures, and for 2022 to 2031, the period covered by the NWMP. Around 77 percent of total costs are allocated for the period covered by the NWMP (see Table 5).

Table 5: Investment costs for municipal waste management as per NWMP (in EUR, constant 2021)

Investment measures	2022-2049	2022-2031
Measures provided for in the Landfill Directive	1,051,142,857	823,857,143
Total for the Waste Framework Directive (excluding double calculation of costs related to the Landfill Directive)	75,901,400	42,167,444
Secondary separation	5,000,000	2,777,778
Waste collection centers ("recycling yards")	19,000,000	10,555,556
Collection of textiles (containers in centers for collection)	100,000	55,556
Biowaste collection (containers and bins)	27,729,529	15,405,294
Composting plants (additional capacities)	24,071,871	13,373,262
In total	1,127,044,257	866,024,587

Source: RS 2022.

The NWMP distinguishes further between costs for measures related to implementing the EU Landfill Directive and related to implementing the EU Waste Framework Directive. For the former, an estimated total of €1,051 million are required. Most of these infrastructure investment costs are related to MBT and RDF production, collection and treatment of biowaste, and incineration facilities (37 percent of €1,051 million), followed by the closure of unsanitary landfills (about 18 percent of €1,051 million) and the opening of new regional landfills (13 percent of €1,051 million). In addition, the NWMP estimates that around €76 million will be required to meet the requirements set by the Waste Framework Directive. This includes investments related to waste collection and primary separation such as bins and containers, the development of waste collection centers, the purchase of containers for the separate collection of textiles and biowaste collection equipment and treatment infrastructure. A separate cost estimate is also provided for investments related to packaging waste. The NWMP assumes a total of €49.5 million of investments (not shown in Table 5) for glass and PET containers and additional sorting capacity for plastics packaging waste.

A detailed costing of planned investments is not provided in the NWMP. The fact that these estimates differ significantly from the investment costs estimates developed within the EU Twinning project for developing a National Waste Management Strategy and Action Plan (RS

2020) suggests that regular reviews of investment needs will be warranted to keep the estimates realistic, identify areas for minimizing costs, and match estimated costs with available financing resources.

According to the NWMP, the private sector is expected to cover about 40 percent of necessary investments. The EU will provide about 15 percent of required investments and donors 1 percent, while the national-level contribution is expected to reach 37.5 percent, including potential loans up to 24 percent of total investment costs. Despite a relatively small share of 6.7 percent, the expected investments by the municipal public sector represent a challenge for the often resource-constrained LSGs and their PUCs. Further, in addition to investment costs, the NWMP estimates that the implementation of the measures envisaged by the Landfill Directive will need to cover around € 5,520 million of operating costs during the period 2021-2049 years.

An overview of municipal finances and waste tariffs is provided in chapter 5.2, while national-level and foreign sources of financing and framework conditions for private-sector investments are being discussed in subsequent chapters.

Table 6: Provisional sources of financing for investment needs in NWMP

Source	**2022 -2049**		**2022 - 2031**	
	EUR (´000)	**%**	**EUR (´000)**	**%**
Public sector - own resources of LSGs, PUCs	75,901	6.7%	42,167	4.9%
Private sector	447,000	39.7%	399,571	46.1%
EU funds	170,000	15.1%	111,571	12.9%
Donors	11,143	1.0%	9,429	1.1%
National participation	152,000	13.5%	98,143	11.3%
Loans	271,000	24.0%	205,143	23.7%
Total	**1,127,044**	**100.0%**	**866,024**	**100.0%**

Source: RS 2022

4.2 Municipal financing of solid waste management services and user fees

LSG units and their affiliated PUCs are responsible for providing solid waste management services. PUCs are organized as non-profit organizations, meaning that all surpluses at the end of a fiscal year are typically absorbed by the superordinate LSG unit, while losses are covered by subsidies including the provision of materials and resources, such as collection vehicles and bins. Most PUCs provide services beyond waste management, such as parking, park maintenance, and funeral services, which increases the risk of unclear cost allocation between different units and cross-subsidies. The current system creates disincentives for PUCs to fully and transparently account for costs and improve business results. While the joint development of waste management infrastructure is the primary motivation for Serbia's

regional approach, the creation of regional, specialized waste management companies is expected to lead to greater financial efficiency (RS 2022).

User fees are a major factor for long-term financial sustainability of waste management services. PUCs or private contractors that provide waste services also collect fees every month, while LSG units oversee enforcement mechanisms. Fees are collected either through a joint system including both waste and utility services in larger towns (mostly for water consumption) or separately. The share of households billed for waste management services ranges from 60 percent in rural areas to 100 percent in urban areas (EEA2021). Consolidated billing has proven to improve the fee collection rate.

National legislation doesn't define any specific methods for determining utility fees, meaning that LSG units set fees in accordance with their own requirements and local conditions. User fees are typically calculated per square meter of residential or commercial space but some municipalities base the fees on the number of household members (see Box 4.1). Depending on type and scope of their main activities, legal entities are classified in different categories of taxes for waste services. This mainly applies for municipal solid waste and some other non-hazardous waste types.

According to the NWMP, the current household fee level for waste management services generally reflects a very low, non-compliant infrastructure. Fees vary considerably, but are mostly around 0.5 percent of household income, often leading to insufficient cost recovery (see also Box 4.1). Fees will have to be increased gradually as new infrastructure is constructed and higher service levels are implemented. Going forward, utility fees should be determined based on the "polluter pays" principle, on full-cost recovery, and be in compliance with the principle of affordability. Regarding the latter, the NWMP defines the affordability threshold for waste tariffs as 1.5 percent of household income. That is higher than thresholds set in other countries in the region, which usually set it at 1 percent. If a threshold of 1 percent was applied, the average monthly tariff for waste management services would be EUR 6.53 per household and EUR 2.27 per household member (see Table 7), which is considerably higher than most current tariffs in Serbia (see Box 4.1). The tariff increase and financial sustainability of services should be an obligatory condition and criteria for providing support from national budget of international donors.

Table 7: average affordability thresholds in Serbia for household waste tariffs

	Household		**Household Member**	
	RSD	EUR	RSD	EUR
Average income per month	76,800	653	26,667	227
Affordability Threshold (1 percent) per month	768	6.53	267	2.27

Source: Based on Statistical Office of the Republic of Serbia 2022.
Note: Own calculation, based on 2.88 members per household. Income figures are from 2021.

Box 4.1: City-specific PUC examples: Novi Sad and Leskovac

In Novi Sad, PUC Hygiene (100% owned by the City of Novi Sad) carries out solid waste management services and collects service fees. Hygiene charges a single user fee, last updated in 2018, for collection, transportation and disposal of waste. Fees for households are based on household members (RSD 147.9 (EUR 1.26) per member and month), while fees for legal entities depend on the registered activity and range from RSD 600 to RSD 2.250 (EUR 5.1 to EUR 19.15) per month. As per the last registered financial report in 2020, Hygiene's revenues were around RSD 1.5 billion (around EUR 13.2 million), while registered total costs were around RSD 1.7 billion (around EUR 14.5 million).

In the City of Leskovac, private consortium PWW, formed by Austrian companies PORR Umwelttechnik GmbH and Werner & Weber Warenhandels-GmbH, carries out waste collection and disposal services. The user fee for collection, transportation and disposal of waste is RSD 164.64 (EUR 1.4) per household member per month. For legal entities, user fees depend on the registered activity and range from RSD 4.72 to RSD 31.05 (EUR 0.04 to EUR 0.26 EUR) per square meter of business space.

As per the last registered financial report in 2020, PWW revenues were around RSD 458 million (around EUR 3.9 million), while registered total costs were around RSD 492 million (around EUR 4.2 million).

4.3 National Sources of Funding, Framework Conditions and Policies

While the private sector is expected to contribute the major share of investments required for the modernization of Serbia's waste management systems in line with the NWMP (see chapter 4.1). The Serbian Government is projected to contribute 37.5 percent of planned investments, including through transfers from state level to local governments, direct investments, and loans. One national instrument for environmental protection was the `Green Fund`, which was established in 2017 and managed by the MEP.

The Fund financed at state, provincial and local government level the preparation, implementation and development of programs and projects in the field of preservation, sustainability, protection and improvement of the environment. It was based on the 'producer responsibility/polluter pays' principle and financed through pollution fees. According to the MEP (2021), in 2019, the Fund provided RSD 3.31 billion (around EUR 28.1 million) to the recycling industry for the reuse and utilization of waste. Experience with the fund showed a lack of planning, monitoring, and evaluation of activities and expenditures, leading to underspending of funds allocated to LSG units. In 2021, the budget line for the Green Fund was abolished in the Budget of the Republic of Serbia with project and program funding previously presented as the Green Fund budget line being intended for a new program under the "EU for Green Agenda in Serbia" (Coalition 27 2021). Going forward, LSG units, which receive national funding intended for funding environmental projects should build additional capacity to improve the management of resources and channel the flow of funds more effectively.

In addition to the provision of national funds for the implementation of the NWMP's investment plan, the Serbian Government plays a key role in setting the right regulatory framework conditions to encourage private sector investments, including through public-

private partnerships (PPPs). The Belgrade Vinca PPP provides a successful example for a PPP in the waste sector (see Box 4.2). Overall however, the waste sector in which the private companies currently operate is uncertain and exposed to high risk. Examples are uncertainty over waste quantities and composition, differences in waste service prices between public and private sector providers, limited political commitment to the regional approach to waste management, and inadequate enforcement of waste management legislation. In addition, local public administrations often have limited experience and understanding of procuring and managing contracts with the private sector, leading to unfavorable contract terms, such as excessively long contract durations, poorly specified service requirements and monitoring procedures, and inadequate financial provisions for landfill closures and remediation measures at the end of the contract term. Successful PPPs on the other hand will require detailed planning, clear and transparent procurement, and diligent management and monitoring; the Serbian Government and international institutions can support LSG units with capacity building and project support.

Box 4.2 Case Study Belgrade Vinca PPP

In 2018, Beo Cista Energija (BCE), a special-purpose vehicle created by a consortium of SUEZ (France), Itochu (Japan), and equity fund Marguerite II (Luxemburg), was awarded a build, design, finance, and operate (BDFO) contract to clean up one of Europe's then largest uncontrolled landfills and construct a new, sustainable waste-management complex to help reduce pollution and mitigate climate change.

The Vinca project includes:

- Closure of the existing landfill site after remediation and stabilization, including leachate treatment and landfill gas extraction and use;
- Construction of a waste-to-energy (WtE) facility with the nominal combustion capacity of about 340,000 t/year of municipal waste, which will generate a combination of electricity (~192 GWh/y) and heat (~175 GWh/y);
- Construction of a sanitary landfill for the part of municipal waste not processed at the WtE facility;
- Construction of a landfill for the disposal of WtE plant residues;
- Construction of a treatment facility for construction and demolition waste and landfill for treatment residues;
- Construction of leachate and landfill gas treatment facilities, and of a landfill gas energy recovery facility.

Construction started in 2019 with landfill operations commencing in 2021. It is expected that the plant will commence commercial operation in the summer of 2023. The PPP contract will conclude in 2046.

The total funding received for the project was USD350 million. Financing and guarantees were provided to BCE from the International Finance Corporation (IFC), the Multilateral Investment Guarantee Agency (MIGA), Oesterreichische Entwicklungsbank (OeEB), and the European Bank for Reconstruction and Development (EBRD).

Sources: https://www.bcenergy.rs; GIHub 2021; Mayhew 2020.

Apart from setting the right framework conditions for PPPs, there are a number of existing and planned economic instruments to incentivize better solid waste management:

i) **Product taxes are already introduced for packaging and certain categories of products placed on the Serbian market**. Producers and importers of tires, products containing asbestos, batteries and accumulators, mineral or synthetic oils and lubricants, electrical and/or electronic equipment, and vehicles are liable to pay product taxes. The taxes vary by type of product and are charged based on the quantity placed on the market. The MEP determines the amount of tax due for each company based on data provided by SEPA. There are no legal requirements specifying how the collected revenues from taxes should be spent.

ii) **The NWMP is envisaging the introduction of a landfill tax**. Additional fees to the already existing landfill fees are planned to be part of the future incentive scheme. The purpose of these fees is to make the use of landfills that do not meet the prescribed conditions more expensive compared to landfills that meet these requirements. Once all regions are covered by eligible waste disposal services, the fees will be developed to encourage the prevention, recycling and treatment of biodegradable waste.

iii) **Presently, the Serbian Government is considering the establishment of a deposit refund scheme (DRS) for beverage containers**. The National Alliance for Local Economic Development (NALED), in association with companies in the Serbian packaging supply chain, commissioned Eunomia Research & Consulting (Eunomia) to undertake a comprehensive study (Eunomia 2021) and to determine the costs and benefits of the introduction of such DRS. The study analyzed three different scenarios based on different technical solutions and use of "smart" technologies. According to the study, the net annual costs for the different scenarios will be in the scale of EUR 13.5 million to EUR 30.9 million. The study further estimates that the establishment of DRS would create more than 1,200 new jobs and double recycled volumes. Additionally, it considers that DRS would reduce littering to approximately a fifth of current volumes and estimates monetarized value of benefits due to reduced litter to EUR 553 million annually. While these estimates will require a review and update before a DRS would be implemented, it is promising to see that the Serbian Government is deliberating a more systematic way to collect beverage containers and capture some of the value of used packaging materials.

4.4 International financing

International donors have been contributing to the financing of environment-related actions in Serbia for several decades now. Some of the major ongoing projects and programs aimed at improving the overall level of environmental protection in Serbia are supported by donors through a mix of budgetary financing and project financing (financial assistance from the Instrument for Pre-accession Assistance 2 (IPA2), World Bank, EBRD, European Investment Bank (EIB), Kreditanstalt für Wiederaufbau (KfW), Agence française de développement (AFD)). The EU and international financial institutions have also provided considerable support in the form of technical assistance to support specifically the waste management sector. As shown

in Figure 7, international support programs are generally framed by sector strategies and 3 to 5 years action plans.

Figure 7: International support for environmental programs

Source: Compiled by report Authors

Negotiations have been ongoing specifically to secure funds for the establishment of the planned 24 regional waste management centers (RWMCs) as part of the NWMP. Some of the reported investments to date include:

- EBRD/AFD consortium: Investment loan of EUR 150 million for the establishment of 8 RWMCs (Kalenić, Duboko, Nova Varoš, Sombor, Pirot, Požarevac, Sremska Mitrovica, Inđija) in two phases (four regions/sites per phase). The implementing body is the MEP
- KfW: Investment loan of approximately EUR 30 million for the establishment of three RWMCs (Vranje, Kruševac, and one additional site). The implementing body is the Ministry of Construction, Transport and Infrastructure.

Further, as part of the ongoing EUR 300 million Green Agenda Public Policy Loan financed by the World Bank, AFD and KfW, the waste management component (led by AFD and KfW) includes the following prior actions to be undertaken:

- Adoption of Waste Management Program and Action Plan; and
- Adoption of the Amendments to the Law on Waste Management.

5 Recommendations

In recent years, Serbia has made progress on updating and improving the regulatory environment for waste management but implementation remains at an early stage. Serbia's solid waste management system is characterized by insufficient waste collection coverage and a lack of primary separation of household waste, underdeveloped waste treatment infrastructure, the persistence of illegal dumps and non-compliant municipal landfills, and slow progress towards the development of sanitary landfills.

The adaptation of the National Waste Management Program (NWMP) for 2022 to 2031 is an important step in addressing the deficiencies of Serbia's solid waste management system as it sets guiding principles and defines clear goals for the sector. These goals are being substantiated with a tangible investment plan that seeks to develop the necessary infrastructure at local and regional level and relies on the assistance of the EU and international financial institutions.

While the planned investments are crucial for achieving the goals set out in the NWMP, more must be done to put Serbia's solid waste management system on sustainable development path in the long-term. The following recommendations are mostly directed at the national level and concern i) data and reporting, ii) targets and policies, iii) inter-municipal cooperation, iv) full-cost recovery, financing, and private sector participation, v) extended producer responsibility and collection systems, and vi) stakeholder engagement and awareness raising.

i. Data and Reporting

This assessment has shown that data on waste generation, treatment, and disposal in Serbia is often incomplete, incorrect or non-existent. The same can be said for reporting on the implementation of local and regional waste management plans. Although data collection and waste reporting starts at the local level, the MEP and SEPA play a crucial role in establishing appropriate data collection and reporting requirements and procedures and enforcing compliance with such requirements. The Government of Serbia should continue with its current efforts to improve reporting in the sector as this provides the basis for better waste planning and implementation.

ii. Targets and Policies

Despite overall good alignment, the Serbian approximation strategy for the waste sector should be regularly reviewed, addressing the higher recycling targets and landfill diversion objectives as these continue to evolve at EU level. A regular review and update of the NWMP would be appropriate to achieve long-term compliance with EU requirements, avoid establishing inappropriate or oversized treatment capacities for municipal waste, enable the achievement of higher environmental objectives, and to provide better quality services to households and other municipal waste generators at affordable costs.

The development of a circular economy is on the Serbian Government's agenda as demonstrated by the recently adopted 2022 – 2024 Circular Economy Development Program. The Government should take the necessary steps to operationalize the Program and ensure its implementation. This also includes a stronger focus on waste prevention and food waste. Serbia has not developed or implemented a waste prevention program as required by Waste Framework Directive, although waste prevention is a stated goal of the overall waste

management approach in the NWMP. There is an opportunity to substantiate waste prevention goals by developing targeted programs and policies that enable progress in this area.

In addition to policy and strategy development at the national level, greater priority should be given to the implementation of targets and policies at the local and regional level. Providing clear guidance on the achievement of targets for reducing biodegradable waste and for recycling municipal waste and setting binding deadlines for closing non-compliant landfill sites will support actions on behalf of LSG units to implement investment projects in the sector. This should be a short-term priority that will allow LSG units and private companies sufficient time to plan and negotiate their investment proposals.

iii. Inter-Municipal Cooperation

The procurement of waste management services and establishment of common regional treatment and disposal infrastructure would benefit from clear implementation mechanisms to support inter-municipal cooperation. The institutional arrangements needed to implement regional waste management systems are not yet widely in place or sufficiently tested in practice. The precise definition of waste management regions and additional regulation and guidance on inter-municipal cooperation in the field is required. The MEP could take a more active role in coordinating implementation of new regional waste management systems, including appropriate guidelines and enforcement mechanisms to support the development of new waste treatment infrastructure.

iv. Full Cost-Recovery, Financing, and Private-Sector Participation

The long-term funding of Serbia's waste management system needs to be based on the "polluter pays" principle, on full-cost recovery, and be in compliance with the principle of affordability. This requires clear policies and guidance on how to define tariffs for households and legal entities. The Serbian Government should develop such guidance and develop mechanisms to ensure that it is applied uniformly across the country.

The present service tariffs are considerably below the internationally recognized affordability thresholds. Their increase will be required to put waste management services on a stable footing. A tariff policy should be based on clear criteria for the affordability of services, such as a percentage of average household income/expenditures. The establishment of pay-as-you throw charging mechanisms should be an additional measure to support waste prevention and recycling.

The introduction of full-cost recovery will require political commitment on national and local levels and is crucial for encouraging private-sector participation in solid waste management. Currently, the private sector is restricted by having to compete on a full-cost recovery basis with public services that are not based on full-cost recovery. A thorough understanding of the full commercial costs of providing waste management services and of their implications for the level and affordability of user tariffs is a crucial requirement for LSG units procuring private-sector services. LSG units currently lack this understanding and the development of clear and realistic guidance on assessing the full costs of municipal waste management systems should be a high priority for the Serbian Government.

Another important, yet underutilized factor for incentivizing private-sector involvement and supporting waste prevention, reuse and recycling, and landfill diversion is the use of

economic instruments beyond the above-mentioned waste tariffs. The Serbian Government should consider the use of appropriate economic instruments such as a landfill levy to support waste prevention, separate collection, reuse and recycling and at the same time generate the necessary funds for closure of non-compliant landfills and dump sites. A deposit refund scheme could contribute to a larger amount of reuse of refillable beverage packaging on the one hand, and higher recycling rates and better material quality on the other hand. It is promising that the introduction of a DRS is currently under discussion.

The implementation of the NWMP will also need direct support from the Serbian Government to LSG units and/or waste management regions through subsidies or grants. The provision national and international grant financing should be based on clear rules and support the achievement of waste management policy objectives. It should guarantee the long-term financial sustainability of waste management system and also include commitments on behalf of beneficiary LSG units such as a gradual increase of waste management tariffs to full-cost recovery levels. State subsidies and project grant financing should not be provided on equal basis and focus mainly on those LSG units facing substantial increases of waste management costs as a result of project implementation. This would cover the financing gap/deficit if costs for project implementation exceed planned revenues generated through affordable waste tariffs. Given the large number of investment projects that are currently planned in Serbia's waste management regions with the support of international and national funding, the Government should define in advance, which conditions waste management regions need to fulfil in order to receive funding.

When it comes to private-sector involvement, the Government should focus on the delivery of those services that are provided least efficiently by the public sector. The main focus of private sector involvement should be technically complex activities/projects and services that require significant investments and operational budgets. The Belgrade Vinca PPP project is good example for such a project. Standard procurement procedures and contract templates are needed to support LSG units with contracting private companies. It is also recommended that toolkits for project preparation, tendering, contract performance monitoring, and basic economic regulation of the sector are prepared at a national level.

v. Collection Systems and Extended Producer Responsibility (EPR)

Collection services – both for recyclable waste streams and residual waste – form the basis of a well-functioning solid waste management system and determine the success of treatment activities downstream. A significant increase in collection coverage and separate collection of recyclable waste streams and biowaste should be considered as important as the establishment of regional treatment and disposal infrastructure. While collection activities fall under responsibility of LSG units, respective legislative requirements and financial mechanisms in support of LSG units and their PUCs should be established.

Technical requirements and standards for separate waste collection and sorting in parallel with EPR schemes could allow the implementation of a limited number of preliminary defined separate collection alternatives by the local government authorities in Serbia. The expected benefits from such requirements would include: i) more reliable planning of separate collection and sorting; ii) reliable estimates of implementation costs that would support financial planning at LSG units, services providers and PROs; iii) the implementation of unified key performance indicator across different local authorities; iv) the incorporation of

requirements into templates for service contracts and future contracts between LSG units and PROs and v) the implementation of common and coordinated communication and awareness campaigns. The requirements should be consulted and agreed upon with all involved stakeholders – state authorities, LSG units, PROs, and service providers.

After several years of mixed experience with Serbia's EPR scheme, the Government should consider measures to improve operations for specific waste streams, in particular for packaging waste, waste from electrical and electronic equipment (WEEE), spent batteries and accumulators, and used tyres. The EPR schemes are considered the main tool to organize, implement and finance separate waste collection and recycling of priority waste streams like paper and cardboard, plastics, glass and metals packaging, WEEE, batteries and accumulators.

As a first step, an in-depth analysis of the current system with its division of responsibilities between LSG units, service providers (mostly PUCs), and PROs is recommended. As part of this activity, an analysis of advantages and disadvantages of implementing different contractual models for organizing separate collection and sorting of municipal waste could be developed. The outcome of the activity would be a clear definition of responsibilities between LSG units, service providers and PROs in implementing separate collection and sorting of municipal waste, achieving "best value for money" through standard and unified procedures and measurable performance indicators. It would also contribute to securing financing of initial investments and implementation costs, achieving more involvement of PROs in planning and implementing separate collection and sorting systems, providing better mechanisms for addressing real implementation costs and reducing some of the cross-material subsidies between different recyclable materials.

The establishment of a coordination mechanism at national level including representatives of state institutions, local authorities, PUCs, PROs, waste management companies, and the recycling industry would support better planning at all levels. This would also support the definition of clear responsibilities between several PROs currently operating in the market. The establishment of a coordination mechanism at national level would allow for better planning of activities by PROs and local authorities and reduce the political and financial risks, create a platform for discussing inefficiencies and difficulties in implementation, guarantee that same rules apply for all players in the market, and eliminate "cherry picking". In the mid-term, the coordination mechanism could help achieving a well-balanced implementation model that guarantees the realization of recycling targets in a cost efficient way and without creating discrepancies on the market.

vi. Stakeholder Engagement, Awareness Raising and Capacity Building

The achievement of higher recycling rates will require active involvement of residents, industry and public sector. Increasing awareness is needed to support the separation at source but also to promote new production and consumption models. It is recommended that the Serbian Government develops a national stakeholder engagement and communications strategy that clearly sets out how to reach out to major stakeholders and increase awareness regarding guiding principles, national goals, and priorities for improving the country's solid waste management system. Such strategy could also include a behavior change playbook to guide campaigns both at national and local level, and communication material templates that could be adopted to fit local circumstances.

Peer learning opportunities at local level, based on existing good practice cases in Serbia, offer an excellent opportunity to improve performance at LSG level. Recent peer learning exchanges by the World Bank and other partners have showcased both the need for capacity building and the demand for such support by LSGs. Scaling up good practice and moving beyond pilot projects towards system wide and accelerated implementation is required if the ambitious national targets for waste management are to be met.

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7 Appendices

Appendix 1: Objectives of the Waste Management Program of the Republic of Serbia for the Period 2022-2031

Specific objective 1: Improved municipal waste management system through increased recycling rate, reduced disposal of biodegradable waste in landfills and reduced disposal of waste in unsanitary landfills

In order to achieve this specific objective, it is necessary to achieve the following:

- increasing the recycling rate of municipal waste to a total of 25% by weight by 2025 and 35% by 2030;
- increase the rate of preparation for reuse and recycling of municipal waste to a minimum of 55% by weight by the end of 2025 and a minimum of 60% by weight by the end of 2030;
- reduction of disposal of biodegradable waste in landfills by 2028, to 75% of the total amount of biodegradable waste generated in 2008
- by the end of 2029, a separate collection of at least paper, metal, plastic, glass and textiles to have been established
- increase the biowaste recycling rate to 20% by 2025 and 40% by 2029; and 35% by 2030;
- increase the recycling rate of paper and cardboard to 25% by 2025 and 40% by 2029;
- reduction of waste disposal in unsanitary landfills to 0% by 2034.

Specific objective 2: Sustainable hazardous and industrial waste management system in place

In order to achieve this specific objective, it is necessary to achieve the following:

- by the end of December 2029, to establish separate collection of hazardous waste fractions produced by households;
- build capacities for hazardous and industrial waste management.

Specific objective 3: Increased rate of collection, reuse and recycling of special waste streams and more efficient use of resources

In order to achieve this specific objective, it is necessary to achieve the following:

- increase the coverage of the system of separate collection of packaging waste to 100% by 2028;
- recycling of the mass share of total packaging waste from 65% by 2025 and 70% by 2030;
    - 50% by weight for plastics by 2025 and 55% by 20302
    - 25% by weight for wood by 2025 and 30% by 2030
    - 70%byweightforferrousmetalsby2025and80%by2030
    - 50% by weight for aluminum by 2025 and 60% by 2030
    - 70% by weight for glass by 2025 and 75% by 2030
    - 75% by weight for paper and cardboard by 2025 and 85% by 2030
- increase the collection rate of waste portable batteries and accumulators to a total of 25% by weight by 2031;
- increase the rate of collection of waste electrical and electronic equipment from households to 45% by 2031;

- increase the rate of preparation for reuse, recycling and other types of reuse of materials, including spreading waste as a substitute for other materials with non-hazardous construction and demolition waste, excluding natural materials defined in category 17 05 04 on the waste list by 40% by 2029.

Specific objective 4 Strengthened capacity of institutions in the field of waste management and regulations harmonized with EU regulations

Strengthening the capacity of institutions refers to the harmonization of the legal framework with the Acquis communautaire, improving monitoring and reporting in the field of waste management, strengthening the capacity of the Environmental Protection Agency and strengthening the capacity of the Environmental Inspectorate. It also implies strengthening the capacity of local self-governments and state administration, as well as regional waste management companies.

Source: RS 2022

Appendix 2: Planned Infrastructure as per the Waste Management Program of the Republic of Serbia for the Period 2022-2031

<table>
<tr><th></th><th>High density population, major cities - Belgrade</th><th>Regions with large settlements – Novi Sad, Nis, Kragujevac</th><th>Other regions</th></tr>
<tr><td>Phase 1</td><td colspan="3">• Waste collection and transport equipment to ensure 100% service coverage
• Transfer stations (where applicable)
• Primary separation of recycled material (initially two-bin system, with the prospect of further development)
• Secondary separation at the regional level
• Home composting (30%)
• Primary separation of green waste and local composting level
• Waste collection centers (bulky waste, electrical waste electronic equipment, waste oil, hazardous household waste)
• Landfills that fully meet the engineering requirements and technological standards
• Closure of existing landfills (cessation of operation, establishment of controlled entrance and fencing)
• Monitoring and reporting equipment</td></tr>
<tr><td>Phase 2</td><td>Converting waste to energy
Further development of primary separation
Home composting volume increase</td><td>RDF production
Home composting volume increase</td><td>Further development of primary separation
Home composting volume increasing
Separate collection and biological treatment of waste</td></tr>
<tr><td>Phase 3</td><td colspan="3">Further separate collection and biological treatment of biodegradable waste
Home composting volume increasing
Reclamation of closed unsanitary landfills</td></tr>
</table>

Source: RS 2022.