III.

Ministerstvo životního prostředí

Economic Analysis

Waste Management Plan of the Czech Republic for the Period 2025– 2035

Ministry of the Environment

2025

The Economic Analysis is part of the Waste Management Plan of the Czech Republic 2025–2035.

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Managerial Summary – Economic Analysis

The economic analysis of the Waste Management Plan of the Czech Republic (WMP CR) describes the impacts of the WMP CR on the economy of the CR, including the impacts on the revenues and costs of municipalities and other waste holders, particularly municipal ones. The document also sets out the **assumptions for the development of technologies and their capacities, with an impact on the investment needs of the waste management sector**, so as to ensure the fulfilment of the WMP CR objectives in the long-term horizon until 2035.

Changes in waste management methods, with the aim of diverting waste from landfilling towards maximising recycling and recovery of waste, represent one of the main factors influencing the increase in the costs of waste management methods throughout the entire chain. Other significant factors include inflation, which substantially and persistently increases costs across all waste management methods and the prices of commodities and products. The anticipated changes in waste management costs are described in more detail further in the economic analysis.

From an environmental perspective, it can be stated that the **WMP CR represents the main instrument for maximising the use of waste as a source of raw materials and energy, thanks to the transformation of waste management towards more efficient waste use** within the circular economy. The key aspect is the positive **shift in the waste management hierarchy and the preference for waste management methods ranked higher in this hierarchy.** For the fulfilment of the WMP CR objectives, an active approach of society as a whole, including a change in the attitude to waste by waste holders, will be absolutely crucial.

An indispensable prerequisite for the successful development of waste management is the acceptance of changes in waste management, including economic impacts, as well as support for the market in products with recycled content, i.e. so-called recyclates.

The implementation of the Waste Management Plan of the Czech Republic is expected to lead to an **increase in employment by up to several thousand jobs.** In the case of the construction of modern waste management facilities, demand is expected for hundreds of highly qualified workers, with further demand arising for construction work, designers and other activities associated with the construction of such facilities. Although the investment costs for these facilities may in future years be reflected in product prices, and thus also in increased household costs, such costs should be offset by positive consequences, such as improved environmental quality, reduced transport burden, etc. Overall, the transition to higher levels of the waste management hierarchy should have a positive impact on citizens' costs. **The construction of modern facilities will also strengthen the competitiveness of individual regions, as well as of the Czech Republic as a whole, since it will have modern technologies requiring highly qualified labour.**

The measures and instruments proposed in the WMP CR are feasible and should deliver the expected effect. The Waste Management Plan of the Czech Republic represents an opportunity for the development of waste management in the CR, and it has been evaluated that, provided all the assumptions considered in the economic analysis are met, it is technically and economically feasible.

Analysis of the Current State

As shown in the Statistical Yearbook of the Czech Republic for 2023, **investments in waste management have been rising in the long term.** In the period 2020 to 2022, they increased from

CZK 4.6 billion to CZK 5.2 billion. **Total costs of waste management in the CR also show a growing trend.** Over the last three recorded years, 2020 to 2022, published within this Yearbook of the Czech Statistical Office, total non-investment costs of waste management in the CR increased by CZK 15 billion, from CZK 45 billion in 2020 to CZK 60.7 billion in 2022.

A significant increase in costs is also recorded in municipal waste management. From 2006 to 2022, the average annual municipal costs of municipal waste increased from CZK 698 per capita to CZK 1,319 per capita. In the last three recorded years, 2020 to 2022, this average annual cost represented an increase of 24 %, from CZK 1,064 per capita to CZK 1,319 per capita. **Over the last ten years, total municipal costs have increased by almost 50 %.**

Costs associated with the collection and transport of municipal waste represent a significant part of the municipal waste management costs within the municipal system. For the evaluated waste streams, the costs associated with the collection and transport of municipal waste within the municipal system always represent the dominant part of the total municipal costs associated with the given commodity. **The share of municipal costs associated with collection and transport amounts to roughly two-thirds of the costs of mixed municipal waste management,** while in the case of the commodity of separate plastic collection, the share of collection and transport accounts for about three-quarters of the costs of this commodity. If the price for handing over a sorted commodity to a facility for its treatment is zero, or the supplier receives payment for it, the average municipal costs consist solely of the costs associated with the collection and transport of this commodity.

Within the available data, it can be stated that the **total costs associated with ensuring compliance with Extended Producer Responsibility increased by 45 % in the period 2019 to 2022.** The largest share of these costs is represented by the costs of ensuring Extended Producer Responsibility for packaging and packaging waste. Their share gradually increased from 69 % to **76 %** of all costs associated with ensuring compliance with Extended Producer Responsibility obligations. From a cost perspective, the second most significant group are the collective systems ensuring the take-back of electrical and electronic equipment.

In the Czech Republic, the collection of data on costs associated with waste management is carried out by the Czech Statistical Office. However, the data are presented without distinction and segmentation by individual types and groups of waste holders. These include both data on investments in environmental protection in the category of waste management, as well as data on non-investment costs of environmental protection in the category of waste management.

Detailed collection of data on costs and revenue in the area of municipal waste, their regular evaluation and presentation, is carried out only at the municipal level. For this reason, it is not possible to adequately assess the costs associated with waste management in other segments, such as industry, construction and in other sectors, to the same extent as at the municipal level. Manufacturing companies have individual contracts with waste management companies, and these data are not publicly available.

In the area of municipal waste management by municipalities, these costs are increasing, as indicated above. The largest share of municipal waste costs in the CR is represented by costs associated with mixed municipal waste. The second most significant group are the costs associated with ensuring separate collection of recoverable waste (paper, plastic, glass, metal, beverage cartons). The third most significant item are the costs associated with the management of biodegradable waste (plant biowaste from greenery).

The largest item of municipal costs is the cost of mixed municipal waste. In 2006, these costs amounted on average to CZK 463 per capita, while in 2022 they had already risen to CZK 652 per capita. In the last three years, **2020 to 2022, these average annual costs increased by 14 %**, from CZK 574 per capita to CZK 652 per capita.

The average annual **municipal costs of separate collection of recyclable and recoverable fractions** of municipal waste increased in the period 2006 to 2022 from CZK 98 per capita to CZK 307 per capita. In the last three years, **2020 to 2022, this increase amounted to 21 %**, with average costs rising from CZK 253 per capita to CZK 307 per capita.

As part of the questionnaire survey, data on municipal revenue related to municipal waste are also collected. According to the presented outputs, in 2022 these average municipal revenues amounted to CZK 911 per capita, which represents an **increase of 24 %** compared to 2020. **The largest share of municipal revenues in 2022 was covered by revenues from residents in the form of payments for municipal waste, while the second largest source of municipal revenues were payments from the authorised packaging company system for ensuring the take-back of packaging waste.** In 2022, these revenues represented on average CZK 181 per capita.

The total amount of municipal revenues is, in most cases, lower than the total costs associated with municipal waste. Municipalities cover the difference between revenues and expenditures from their budgets. On average, in 2022 municipalities had to allocate **31 %** of their budgetary funds to ensure the functioning of waste management. In 2023, this share increased to **34 %**.

As part of the analysis of costs associated with input prices for waste management facilities, the highest prices are represented by technologies handling hazardous waste, i.e. hazardous waste incineration plants (up to CZK 25,000/t) and hazardous waste landfills (up to CZK 10,000/t). At the opposite end of the spectrum are metal recycling facilities (the purchaser pays up to CZK 20,000/t).

Modelling of Future Developments

For the purpose of assessing the impacts of individual scenarios of waste generation and methods of municipal waste management, **six scenarios** were created. **Two trajectories of waste generation were prepared according to individual waste streams, and three scenarios of waste management methods with the objective of meeting legislative requirements relating to municipal waste in terms of recycling and landfilling.** The economic analysis then evaluated all six of these scenarios. Within the economic analysis, significant factors influencing costs were also taken into account, such as the development of the population of the CR, the development of inflation, the development of landfill fee rates, etc.

As regards municipal waste costs, **in all scenarios the total costs of municipalities for municipal waste management increase. In 2035, it can be expected that the total municipal costs for municipal waste will exceed CZK 27 billion annually**, which is essentially double the level in 2022. **It can be expected that average annual unit costs per capita in the period 2025 to 2035 will increase by approximately CZK 700 per capita**, i.e. an increase of almost 40 % compared to the assumed municipal costs in 2025. Since the modelling of future developments uses 2022 waste management prices as the baseline, it is appropriate to present the cost difference also in the period 2022 to 2035. This **difference, averaged across all scenarios, represented an increase in annual costs of CZK 1,200 per capita.**

As part of the modelling of the future development of costs for municipal waste within municipal systems, the sensitivity of the growth of municipal costs to inflation was also tested. The result of the testing shows that an increase in inflation, according to the baseline assumption of the analysis, will raise municipal costs in the period 2022 to 2035 by almost CZK 1,000 per capita.

It can be assumed that, under the defined conditions of the analysis, **municipal costs associated with the sub-stream of "separately collected waste" between 2025 and 2035 will increase by CZK 8 billion,** taking into account the development of its generation and price developments, including the impact of inflation.

Municipal costs associated with the sub-stream of "hazardous waste" are negligible compared to other sub-streams. In the long-term horizon, their stagnation can be expected.

On the basis of the defined conditions of the analysis, it can be assumed that the costs associated with the sub-stream "*other waste*"[1] will reach their maximum in the period 2028 to 2030. After this period, costs will decrease due to the reduction in the total quantity of such waste (effect of the growth of separate collection). An increase in costs associated with the sub-stream "other waste" is expected only in the period 2025 to 2028, by approximately CZK 0.6 billion. In the subsequent period and after 2030, a decrease in costs by CZK 1.5 billion is expected by 2035. From 2025 to 2030, the share of costs associated with separately collected waste will increase by 8 percentage points, and between 2030 and 2035 this share will increase by a further 10 percentage points. Accordingly, the share of the sub-stream of other waste in the total municipal costs will decline. The share of the sub-stream of hazardous waste remains more or less unchanged over time.

According to the analysis carried out and the evaluation of individual scenarios of waste generation and management in relation to the **assumed extent of co-financing of individual waste streams by the current and forthcoming EPR systems**, it may be assumed that the net costs of all municipalities cumulatively, after deduction of these revenues, will amount to just under CZK 17 billion in 2025, just under CZK 18 billion in 2030, **and just under CZK 19 billion in 2035.** From the perspective of the impact on citizens, these will be costs that should also be transferred to citizens. In the period 2025 to 2030, an **increase of approximately CZK 140 per capita** can be expected. In the subsequent period to 2035, the increase in costs per capita should be more gradual, with an expected annual increase of just under **CZK 100 per capita.**

The total costs associated with municipal waste for **other holder** increase significantly until 2025, followed by a more gradual growth until 2035. **The total increase between 2022 and 2035 is, according to the average value of the scenarios, CZK 2.6 billion.** Overall, the costs associated with the sub-stream of separately collected waste between 2025 and 2035 will increase by CZK 1.7 billion, including the effect of inflation.

The costs of other holders associated with the sub-stream of hazardous waste are negligible compared to other sub-streams. In the long-term horizon, their stagnation can be expected.

The costs of other holders associated with the sub-stream of other waste will reach their maximum in the period 2025 to 2026. After this period, costs will decrease due to the reduction in the quantity of such waste (effect of the growth of separate collection). An increase in costs associated with this sub-stream is expected only in the period 2022 to 2026, amounting to approximately CZK 1.3 billion. In the subsequent period, a decrease in costs of approximately CZK 0.9 billion is expected by 2035. From 2025 to 2035, the share of costs associated with the sub-stream of separately collected waste will increase by 20 percentage points. The share of the sub-stream of hazardous waste remains unchanged over time.

Necessary Investments

The following presents the assumptions regarding investment needs to ensure the development of

[1] The sub-stream 'Other waste' is defined in Chapter 5.1.1.3.

waste management in the Czech Republic with the aim of meeting the required objectives of the Waste Management Plan of the Czech Republic.

For each waste stream, the capacity needs of the various groups of technologies were assessed. Differences were defined between the required quantities of waste to be processed in individual years and the currently existing capacities. **The highest investment expenditure per annual unit of processed waste is associated with investments in hazardous waste incinerators, medical waste incinerators, and facilities for energy recovery of waste.**

For the purposes of the WMP, **investments were also calculated for the development of the collection network for separately collected recoverable waste fractions** collected within municipal waste originating from municipalities. These concerned investments into the expansion and development of the collection network linked to the growth in separately collected quantities of individual commodities, not its renewal, as such costs are subsequently reflected in operating costs. In the field of container-based collection, **the highest investment expenditure is associated with commodities for which intensive implementation of the door-to-door system is expected. These are primarily paper, plastics, and biowaste. Investments in containers for the collection of these commodities represent almost 90% of the total anticipated investment expenditure for the development of the collection network. The total investments in the development of the collection network (container collection and collection yards) for its expansion are expected in the period 2025 to 2035 at CZK 6.5 to 7.4 billion.**

For municipal waste, assumptions regarding the required capacities of technologies that will be used primarily for the management of individual municipal waste streams under six scenarios of waste generation and management were also calculated. For these capacities, the anticipated necessary investments were then quantified for the individual periods.

In all scenarios, the greatest need to build new capacities by 2030 is in the area of energy recovery from waste and transfer stations. The opposite is true for paper-sorting capacities.

The highest investment expenditure by 2030 relates to technologies for **energy recovery from waste.** Significant investment costs can also be expected for the construction of technologies for the mechanical sorting of mixed municipal waste. After 2030, unlike the previous period, no significant need for new capacities is expected, with a few exceptions. **Overall, in the period 2025 to 2035, key facilities for the management primarily of municipal waste or outputs from its treatment will be required with a capacity of 2.5 to 5 million tonnes of waste.** These capacities are distributed among various groups of waste treatment or final disposal technologies.

As part of the reconstruction of existing capacities, it will be necessary to modernise facilities with a total capacity of at least 0.9 million tonnes of waste.

In the horizon of the period 2025 to 2035, the total expected investments in technologies primarily ensuring the management of municipal waste according to the defined scenarios range between CZK 32.5 and 65.3 billion.

If the expected investments in the reconstruction and modernisation of key technologies for handling municipal waste, such as sorting lines for paper and plastics and technologies for handling biowaste, are added, the projected investments will range between CZK 48.4 and 82.7 billion.

Technologies for managing hazardous waste are investment-intensive. The expected total investment expenditures in the period **2025–2035 will amount to around CZK 12.3 billion.** The largest expenditures are allocated to the construction and reconstruction of hazardous waste incineration plants. Total investments in these technologies are expected to be approximately **CZK 8.9 billion.**

Technologies for processing construction and demolition waste will require a very high level of new capacity. However, the investment costs are relatively low when calculated per tonne of new capacity. Approximately half of the capacity value and investment costs relate to the reconstruction of existing capacities (approximately 65% of the total required capacity).

If the Czech Republic were to require the **provision of recycling capacities for 100% of separately collected material-recoverable waste directly within its territory**, it would be necessary to secure new recycling capacity for **paper** of 1 million tonnes per year. In terms of investment, this would amount to around **CZK 45 billion.** Furthermore, it will be necessary to expand existing recycling capacities for **plastics** by approximately 300,000 tonnes per year. The investment expenditures for building these technologies can be expected at around **CZK 4.2 billion.** It will also be necessary to ensure an expansion of **metal** recycling capacities by 1.8 million tonnes per year. The investment expenditures would amount to approximately **CZK 11.9 billion.** The required new capacities for processing metals are largely influenced by the current state and further development of the metallurgy sector in the Czech Republic. The required capacity of **glass** recycling technologies amounts to about 100,000 tonnes by 2035. The technologies should focus on facilities for the treatment and processing of waste glass into very high-quality input raw materials for glassworks, or technologies for the production of final products. The investment expenditures are very low, at around **CZK 100 million.** A commodity whose production is expected to grow significantly is textile waste. Increase in the capacity of technologies to ensure the treatment of textiles that will not be handed over for reuse is estimated at around 100 thousand tonnes in 2035. The expected investment expenditures are around **CZK 1 billion..**

Note: The estimates of investment costs (unit costs) are based on an expert market and literature review from 2023 and may differ in reality depending on the development of the economic environment.

Summary

The implementation of the Waste Management Plan of the Czech Republic is expected to lead to an increase in employment by up to several thousand jobs. In the case of the construction of modern waste management facilities, demand is expected for hundreds of highly qualified workers, with further demand arising for construction work, designers and other activities associated with the construction of such facilities. Although the investment costs for these facilities may in future years be reflected in product prices, and thus also in increased household costs, such costs should be offset by positive consequences, such as improved environmental quality, reduced transport burden, etc. Overall, the transition to higher levels of the waste management hierarchy should have a positive impact on citizens' costs. The construction of modern facilities will also strengthen the competitiveness of individual regions, as well as of the Czech Republic as a whole, since it will have modern technologies requiring highly qualified labour.

Summary
Benefits of the WMP CR
➢ **opportunity for the development of waste management in the CR;** ➢ **transformation of waste management towards more efficient waste recovery;** ➢ **positive shift in the waste management hierarchy;**

- **maximisation of waste recovery as a source of raw materials and energy;**
- **modern technologies and construction of modern facilities;**
- **increase in the number of jobs, qualified workers;**
- **enhancement of the competitiveness of regions and the CR;**
- **the proposed measures and instruments are feasible;**
- **the Plan is technically and economically feasible;**
- **overall positive impact on citizens' costs.**

Current State of Waste Management

- **investments in waste management are rising in the long term** (CZK 5.2 billion in 2022);
- **total costs of waste management are rising** (CZK 60.7 billion in 2022);
- **significant growth in costs is recorded in municipal waste management;**
- **over the last ten years, the total costs of municipalities for waste management have increased by almost 50 %** (average annual municipal costs for municipal waste were CZK 1,319 per capita in 2022);
- **municipal costs associated with collection and transport represent roughly two-thirds of the costs of managing mixed municipal waste;**
- **average annual costs of mixed municipal waste increased by 14% over the last three-year period from 2020 to 2022** (CZK 652 per capita in 2022);
- **average annual costs incurred by municipalities for the separate collection of recyclable and recoverable components of municipal waste increased by 21% over the last three-year period from 2020 to 2022** (CZK 307 per capita in 2022);
- **average municipal revenues increased compared to 2020 by 24 %** (CZK 911 per capita in 2022);
- **the largest share of municipal revenues is covered by revenues from residents through payments for municipal waste, the second largest source of revenues are payments from the system of the authorised packaging company for packaging waste** (CZK 181 per capita in 2022);
- **the total amount of municipal revenues is in most cases lower than the total costs associated with municipal waste management;**
- **municipalities cover the difference between revenues and expenditures from their budgets** (on average 31 % in 2022);
- **total costs associated with ensuring compliance with extended producer responsibility (EPR) obligations increased by 45% over the period from 2019 to 2022.**
- **the largest share of EPR costs** is attributable to the costs of ensuring extended producer responsibility for **packaging and packaging waste (76%** of all costs associated with ensuring compliance with extended producer responsibility obligations);
- **the second largest costs are incurred by collective systems for electrical and electronic equipment.**

Waste Management Modelling

- for municipal waste management, 6 scenarios are modelled: 2 trajectories of generation and 3 scenarios of waste management methods aimed at meeting binding recycling and landfilling targets;
- in all scenarios, total municipal costs of managing municipal waste rise, reaching CZK 27 billion in 2035;
- average unit annual costs per citizen in the period 2025 to 2035 will increase by approx. CZK 700 per capita, the average increase in annual costs across all scenarios is CZK 1,200 per capita;
- municipal costs associated with separately collected waste (separate collection) will increase by CZK 8 billion between 2025 and 2035;
- with co-financing of individual waste streams by existing and planned EPR schemes, it can be assumed that the cumulative net costs of all municipalities, after deduction of these revenues, will amount to just under CZK 19 billion in 2035;
- for EPR, in terms of impacts on citizens, these will be costs that should also be transferred to citizens; in the period 2025 to 2030, an increase of approx. CZK 140 per capita may be expected, and in the following period 2035 the annual increase in costs per citizen will be CZK 100 per capita;
- total costs related to municipal waste of other waste holders are increasing, with the growth by 2035 amounting to CZK 2.6 billion according to the scenarios.

Required Investments in Waste Management (by 2035)

- an assumption of investment needs has been prepared to ensure the development of waste management;
- the highest investment expenditure per annual unit of processed waste is associated with investments in hazardous waste incinerators, medical waste incinerators, and facilities for energy recovery of waste;
- significant investments will be required for the development of the collection network for separately collected recoverable waste;
- total investments in the development of the collection network (container collection and collection yards) for expansion by 2035 will range between CZK 6.5 and 7.4 billion;
- the highest investment expenditure will be for commodities where the intensive introduction of a door-to-door system is expected (paper, plastic and biowaste), investments in collection containers for these commodities represent 90 % of the total anticipated investment expenditure for the development of the collection network;
- in all scenarios, the greatest need for the construction of new capacities by 2030 is in the field of energy recovery of waste and transfer stations;
- significant investment costs will be required for the construction of technologies for the mechanical sorting of mixed municipal waste;

- **after 2030, no need for significant new capacities is expected, overall in the period 2025 to 2035 key facilities will be required for the management of municipal waste or outputs from its treatment with a capacity of up to 2.5 to 5 million tonnes of waste (various waste treatment and final processing technologies);**
- **total investments in municipal waste management technologies by 2035 according to the scenarios will range between CZK 32.5 and 65.3 billion;**
- **Total investments, including the expected investment in the reconstruction and modernisation of key municipal waste management technologies, such as paper and plastic sorting lines and technologies for the treatment of biowaste, will range between CZK 48.4 billion and CZK 82.7 billion;**
- **investments to ensure recycling capacities for all separated materially recoverable waste in the territory of the CR;**
- **new capacities for paper recycling (approx. 1 million tonnes, CZK 45 billion);**
- **new capacities for plastic recycling (approx. 0.3 million tonnes, CZK 4.2 billion);**
- **new capacities for metal recycling (approx. 1.8 million tonnes, CZK 11.9 billion);**
- **new capacities for glass recycling (100 thousand tonnes, CZK 100 million);**
- **new capacities for textile recycling (approx. 100 thousand tonnes, CZK 1 billion);**
- **hazardous waste management (by 2035 approx. CZK 12.3 billion);**
- **construction and modernisation of hazardous waste incineration plants (approx. CZK 8.9 billion).**

Introduction

This chapter contains an evaluation of the economics of waste management and the economic assessment of the main objectives set in the WMP CR. Furthermore, this document includes the identification of the financial resources required to meet the objectives of the WMP CR, the identification of the amount of financial resources for investments in technologies, and also the amount of resources for operation, for example within municipal and other systems.

Waste management is a significant component of public finances, primarily not by its relative size in terms of the amount of financial resources flowing through the sector annually, but by its social impact – a functional waste management system is an important condition for prosperity and concerns every individual member of society. Therefore, part of the Waste Management Plan of the Czech Republic is also the evaluation of the economic impacts of implemented policies (objectives) on the main stakeholders and waste holders.

It also includes a projection of new investments necessary to meet legislative objectives, as well as an outlook of the expected costs associated with the introduction of individual measures to meet the ambitious objectives in the field of waste management and the circular economy of the CR and their impact on society.

1. Environmental and Economic Evaluation of the Objectives of the WMP CR

1.1 Economic Impacts

The economic impacts of the objectives set out in the Waste Management Plan are described in more detail in other chapters of the document, which contain an analysis of costs, revenues, and prices in waste management.

In the future, a gradual increase in prices can be expected not only in the field of waste management. In order to meet the objectives set by the European Union and consequently by the Member States of the European Union, it will be necessary to invest substantial financial resources in modern technologies within the network of waste management facilities. Due to the ban on landfilling certain types of waste from 2030, it will also, for example, be necessary to seek new ways of recovering or disposing of waste that has so far been deposited in landfills. The network for the separate collection of materially recoverable waste components, as well as products with an end-of-life, will undoubtedly also be expanded. All the aforementioned, as well as other measures, will require significant financial resources for investments in waste management, which will then undoubtedly be reflected in product prices and in waste management obligations. Price increases will then also have an impact on the final prices of waste management for citizens and municipalities. In view of the necessity of investments in the field of waste management, the Czech Republic will, nevertheless, have to cope with these challenges. The analyses in the following chapters also indicate that the cost burden for citizens and municipalities, despite the high investments, will be relatively similar to that of the preceding years. The transition to higher levels of waste management according to the waste management hierarchy should then also have its positive aspects, which may again be positively reflected in the economy – besides a better quality environment for life, this includes, for example, lower waste generation, higher rates of waste recovery and its conversion into secondary raw materials, and thereby lower raw material dependence on other countries, etc.

Proper waste management and investments in waste management facilities and their efficient location may then lead to cost reductions in many respects, for example the reduction of costs of the disposal of legal or illegal landfills or the reduction of costs of waste transport. Waste management at the lower levels of the waste management hierarchy may, moreover, carry indirect costs, for example in the form of increased health care costs due to a polluted environment and poor air quality.

The extension of the obligations of the European Emissions Trading System (EU ETS) to other sectors, such as transport, electricity and heat generation, housing and other sectors, will have a significant impact on the economy. The inclusion of these sectors in the EU ETS means that companies and organisations will have to purchase allowances for greenhouse gas emissions, which will lead to a financial burden and a potential increase in the prices of their services and products.

An increase in the costs of waste management is one of the direct consequences, as these activities often involve a significant component of transport and energy intensity, which will now be subject to new costs for emission allowances. However, this increase in costs is not limited solely to the waste sector. Transport is a key component of most supply chains, and therefore the costs of emission allowances will be reflected in the prices of almost all goods and services, which may lead to an overall increase in market prices. The impact of rising costs may be partly mitigated by the transition to electromobility and hydrogen technologies in transport, as well as by the use of more environmentally friendly technologies, renewable energy sources, and the modernisation of buildings into carbon-neutral buildings.

1.2 Environmental and Social Impacts

As already mentioned, shifting waste management to higher levels in the waste management hierarchy, that is towards waste recovery and recycling and the circular economy, undoubtedly has a positive effect on the environment. Higher levels of the waste management hierarchy are more often environmentally friendly, reduce greenhouse gas emissions, and help create a better quality living environment for citizens. Even in the case of waste management at the lower levels of the waste management hierarchy, there is nevertheless room for improvement since some waste cannot be treated in any other way than by disposal. Therefore, investments in more modern waste incineration facilities also have their importance from the perspective of environmental protection.

Shifting waste management to higher levels of the waste management hierarchy will also undoubtedly require an increase in the number of qualified employees. The development of modern technologies places higher demands on employees who operate these modern technologies, but also design, plan, or construct, supply, and put them into operation. In future years, the creation of several thousand jobs may therefore be expected, depending on the number of newly built waste management facilities and their capacity. Apart from waste management facilities, an increase may also be expected in the number of companies dealing with recyclates. In this case, too, an increase in the number of jobs may be expected, depending on the production of recyclates.

The prevention of landfilling of waste in the coming years will also have positive effects on agricultural land and land in general. Landfills also generally produce large amounts of methane, which is a greenhouse gas and may contribute to climate change if its maximum capture and energy recovery is not ensured. Hazardous substances concentrated in landfills may, in the event of an accident, leach into watercourses and groundwater, from which they may indirectly enter the human organism. Waste management at the higher levels of the waste management hierarchy therefore, in addition to preventing soil contamination, contributes to the protection of water, air, and thereby also human health.

Pressure on waste prevention, as the highest level of the waste management hierarchy, may have impacts on citizens' behaviour. These pressures may be exerted legislatively, but also by the media or through citizens' awareness. Examples of such influences include, for instance, the pressure to reduce or eliminate so-called "fast fashion". Furthermore, the reduction in the use of single-use plastic products, the utilisation of home composting, or the use of own packaging in shops.

The transport of waste over longer distances may lead to higher greenhouse gas emissions and increased fuel consumption if transport is carried out predominantly by road. Nevertheless, the use of railways for waste transport offers significant advantages. Rail is more efficient and less burdensome for the environment than road transport, as trains can carry larger volumes of cargo with lower fuel consumption and lower emissions per tonne and kilometre. This reduces the overall impact on air quality and contributes to the mitigation of global warming. Another significant step towards greener transport is the potential transition to the use of hydrogen in both rail and road transport. Hydrogen trains and vehicles produce zero emissions at the point of operation, meaning they do not generate harmful emissions such as nitrogen oxides or fine particles, which may negatively affect air quality and public health. If hydrogen is produced from renewable energy sources, the overall impact on the environment will be even smaller.

1.3 Assessment of the Feasibility and Economic Viability of the WMP CR

The WMP CR is technically feasible and economically viable.

Economic viability is determined by the setting of European objectives. Failure to comply with these will subsequently be sanctioned. Sanctions motivate central authorities to create such a business environment that will encourage investors from both the public and private sectors to invest in the necessary technologies or systems in order to increase the likelihood of ensuring the fulfilment of objectives in the future. Investors may further be motivated by subsidies from programmes administered from the Czech Republic as well as direct programmes managed by the European Union or the European Investment Bank, or by other entities.

The WMP CR is also technically feasible. The WMP CR provides a clear description of the available capacities as well as the volume of capacities required for individual streams. **The WMP CR does not propose specific locations for new capacities but indicates in which regions capacities are insufficient. It is up to investors to adapt to this situation and to propose appropriate measures. The WMP CR is therefore a recommendatory strategic document.** For this reason, all responsibility for assessing environmental impacts lies with the investors. The WMP CR also presents known technologies that are available. It does not prescribe or favour particular types of technology. **Since the WMP CR is technologically neutral, it may be considered technically feasible.**

The WMP CR also states, however, that capacities for the management of certain types of waste must be built. Again, it is emphasised that it does not specify which particular technologies, but only capacities for certain types of waste. This is also a fact confirming the technical feasibility of the WMP CR as a strategic document.

1.4 WMP CR as an Opportunity

The WMP CR is a strategic document which clearly represents an opportunity for the Czech Republic. It defines the necessary capacities for waste management, which brings both the development of technologies and room for new jobs. The principles, measures, and SWOT analysis define the areas where there is room for increasing the competitiveness of the CR. In the aforementioned parts of the strategic document and within the instruments, opportunities are then defined as to how to achieve the fulfilment of European objectives in waste management and for the transition to a circular economy.

2. Analysis of Costs, Revenues, and Prices in Waste Management

Costs of waste management generally depend on the quantity and structure of the waste generated for which obligations are ensured, on the scope and method of providing the fulfilment of obligations in accordance with legislative requirements, and last but not least also on mandatory expenditures stipulated by legislation. Among the significant influences affecting the above-mentioned factors may be included the standard of living of the population in individual regions and their consumption patterns, population density, geographical conditions, transport accessibility of the territory, methods of collection and transport of commodities, availability and equipment of waste management technologies, competition among waste management companies, methods of price-setting for individual activities, and waste management practices in the field of waste management, among others.

The Czech Statistical Office, within the Statistical Yearbook of the Czech Republic, provides a comprehensive statistical overview of all branches of the national economy, including the environment and investment and non-investment costs.

Within this statistical overview, investment expenditures and non-investment costs associated with waste management are also given. Waste management, as defined in the methodology of the Czech Statistical Office, includes the modification of technological processes for the purpose of waste prevention, equipment and facilities for the collection, transport, carriage, sorting, and treatment of waste, the construction of incineration plants, recycling plants, controlled landfills, composting facilities, remediation of old landfills, facilities for waste monitoring, etc.

Expenditure on environmental protection includes expenditure on the acquisition of long-term tangible assets for environmental protection and non-investment costs for environmental protection. The data are obtained from the annual statistical report of the Czech Statistical Office. Data on long-term tangible assets (hereinafter also "LTA") represent the total of expenditures incurred by reporting units for the acquisition of LTA (through purchase or own activity), together with the total value of LTA acquired free of charge or transferred under the relevant legislative provisions or reclassified from personal use to business use. Non-investment costs include personnel costs, rental payments, energy and other materials, and payments for services, where the principal purpose is environmental protection.

A comprehensive overview of the development of expenditure **on environmental protection – waste management** is given in the following table.

Table*1*: *Development of Expenditure on Environmental Protection – Waste Management, Including the Development of the Average Annual Rate of Inflation*

Year	Investments in Environmental Protection – Waste Management (CZK million)*	Non-Investment Costs of Environmental Protection – Waste Management (CZK million)*	Average Annual Rate of Inflation Expressed as the Increase in the Average Consumer Price Index (%)*
2015	5,645	34,456	0.30
2016	3,293	36,584	0.70
2017	3,354	40,220	2.50
2018	5,476	43,327	2.10
2019	4,989	44,910	2.80
2020	4,670	45,274	3.20
2021	4,751	58,707	3.80
2022	5,192	60,722	15.10

Source: *Statistical Yearbooks of the Czech Republic 2023. ** Czech Statistical Office, Extract from Survey – Average Annual Rate of Inflation – 2000–2023

If we compare the development of investment and non-investment costs in waste management with the average annual rate of inflation (consumer price index)

When taking into account the development of the average annual rate of inflation, real investment expenditure related to waste management according to the Statistical Yearbook of the Czech Statistical Office declined between 2015 and 2022. Its level was 31 % lower than the rate of inflation over the given period. By contrast, non-investment costs rose faster than the price level, by almost 32 %. Given the prevailing influence of non-investment costs on the total resources directed towards waste management, there was a real increase in financial resources of 23 % over the period between 2015 and 2022.

Real investment expenditure related to waste management declined between 2015 and 2022.

Non-investment costs for environmental protection – waste management rose faster than the price level.

Detailed data collection on costs in waste management is carried out only at the level of municipalities and the management of municipal waste.

In the evaluated period, the collection of data on costs and revenues related to municipal waste management within municipal systems was carried out only by the Authorised Packaging Company. For the purpose of evaluating the development of costs and revenues in the field of municipal waste within municipal systems for the purposes of the WMP CR, these data were used. From 2025, the collection of these data will be ensured by the MoE, within the framework of regular annual reports of aggregate data from the waste records of waste holders.

2.1 Municipal Waste Costs within the Municipal System

Total Cost

The total costs of municipal waste management are the sum of all cost items. When recalculated per capita, municipalities are thus able to compare the total level of expenditure on waste management.

As shown in the following graph (Graph 1)which depicts the structure of total costs, the largest share of total costs is borne by the costs of collection and transport of mixed municipal waste (in 2022 this amounted to 49 %). This was followed by the costs of collection and transport of separately collected waste, which accounted for roughly 23 %. Other components were bulky waste costs (7 %) and biowaste costs (6 %).

Approximately 15 % of the total costs relate to other items, which include, for example, the costs of operating a collection yard, removing waste deposited outside designated areas[2], street litter cleaning, or the collection and transport of hazardous waste. These other items are generally reported only by certain municipalities.

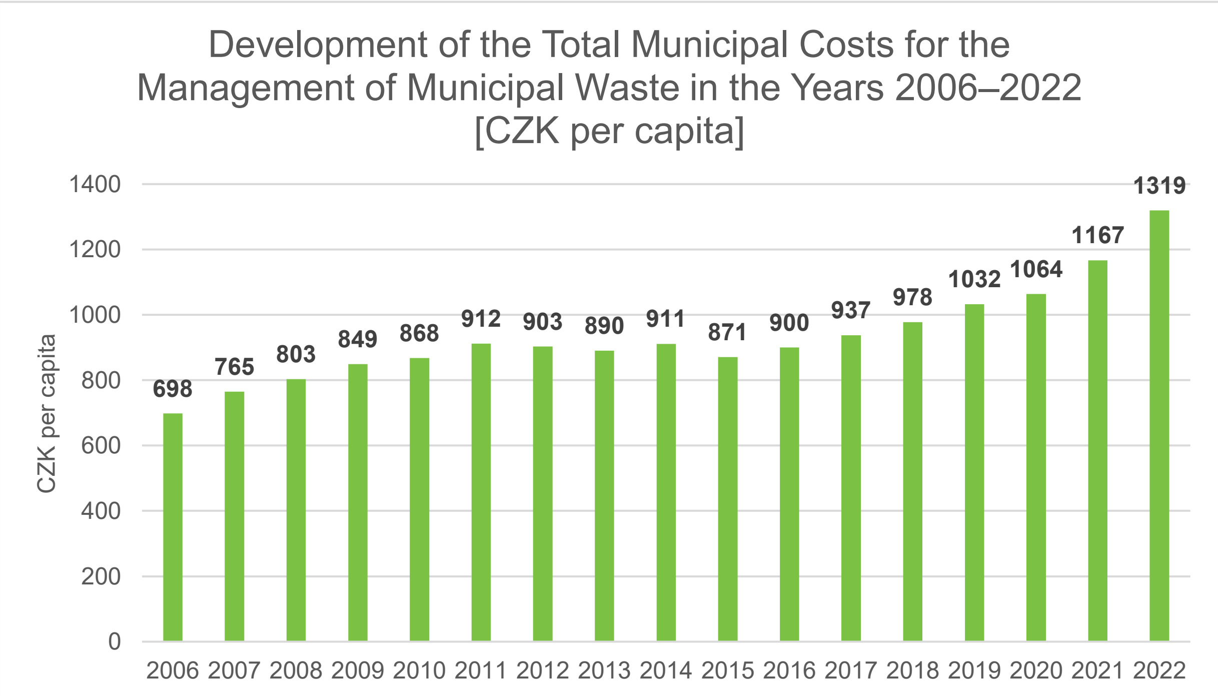
[2] so-called illegal dumps

Graph 1: Structure of Municipal Costs for the Management of Municipal Waste in 2022

Source: processed on the basis of data of the Authorised Packaging Company

When comparing historical data, a significant increase in municipal waste costs over time is apparent. While in 2006 municipalities in the Czech Republic paid on average CZK 698 per capita in the field of waste management, in 2022 this amount was already CZK 1,319 per capita. In particular, over the last six years a constant significant growth can be observed, reinforced in the last year also by marked inflation.

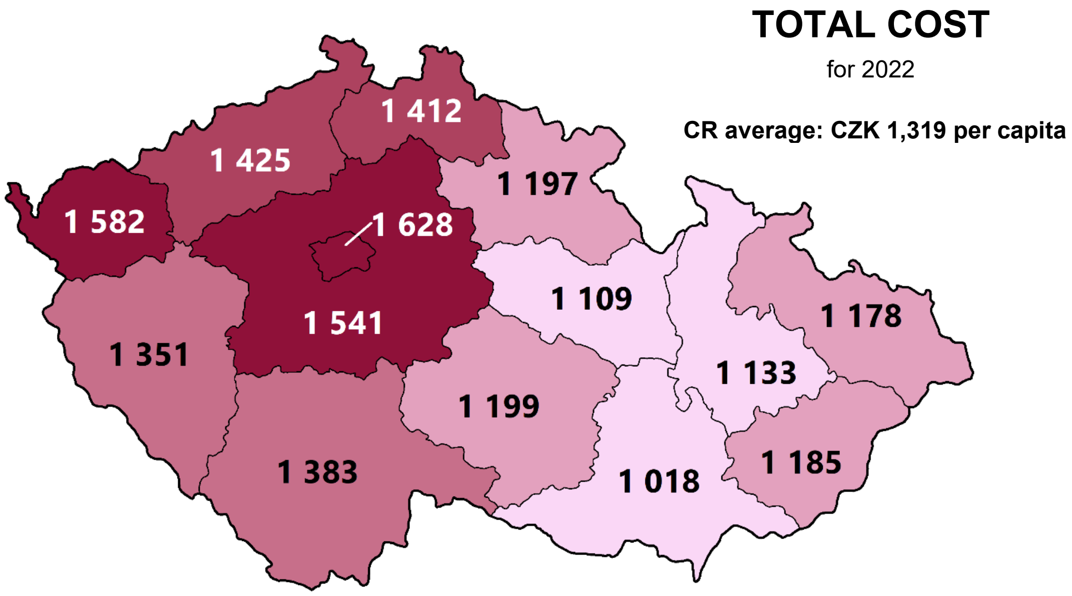
Graph 2: Development of the Total Municipal Costs for the Management of Municipal Waste in the Years 2006–2022 (CZK per capita)



Source: processed on the basis of data of the Authorised Packaging Company

For the purposes of regional comparison, the following map (Figuer1) shows the average total municipal costs for the management of municipal waste by regions as well as by size groups of municipalities. The map shows that the highest average total municipal costs for municipal waste are in the Capital City of Prague (CZK 1,638 per capita) and the Central Bohemian Region (CZK 1,541 per capita), which may be attributed to the generally higher price level in these regions than in other regions of the Czech Republic. High costs are also recorded in the Karlovy Vary Region (CZK 1,582 per capita), the Ústí nad Labem Region (CZK 1,425 per capita), and the Liberec Region (CZK 1,412 per capita). In these regions, the higher price may be attributed to various problems, such as population density, type of development, walking distance for waste management, method of waste collection and transport, etc.

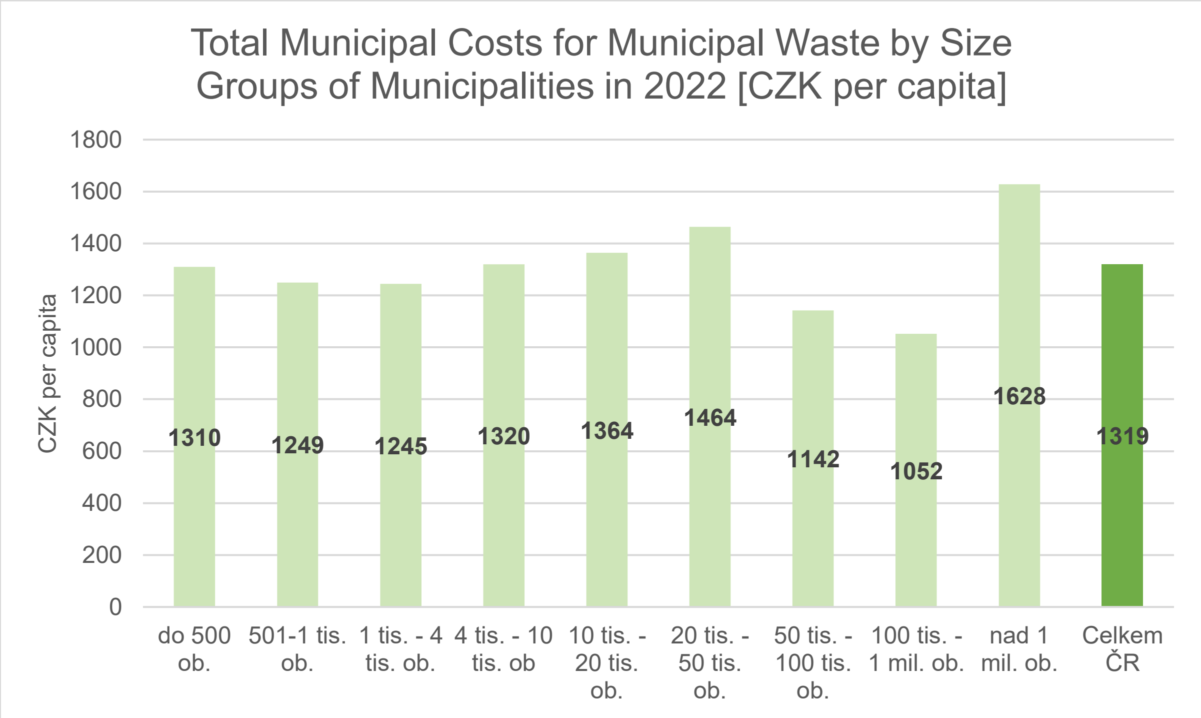
Figuer1: Total Municipal Costs for the Management of Municipal Waste by Regions in 2022



Source: Authorised Packaging Company

The following graph (Graph 3) shows the level of total municipal costs for municipal waste according to the size groups of municipalities in the Czech Republic. It is evident that the level of costs for municipal waste is similar in municipalities with 500 to 20,000 inhabitants, being slightly higher in municipalities with between 20,000 and 50,000 inhabitants. Noticeably lower are the costs in municipalities with 50,000 to 100,000 inhabitants (CZK 1,142 per capita) and in municipalities with 100,000 to 1 million inhabitants (CZK 1,052 per capita). The highest average costs for municipal waste are in the Capital City of Prague, where in 2022 they amounted on average to CZK 1,628 per capita. The lowest average total costs are in the South Moravian Region (CZK 1,018 per capita), the Pardubice Region (CZK 1,109 per capita), and the Olomouc Region (CZK 1,018 per capita).

Graph 3: Total Municipal Costs for Municipal Waste by Size Groups of Municipalities in 2022 (CZK per capita)



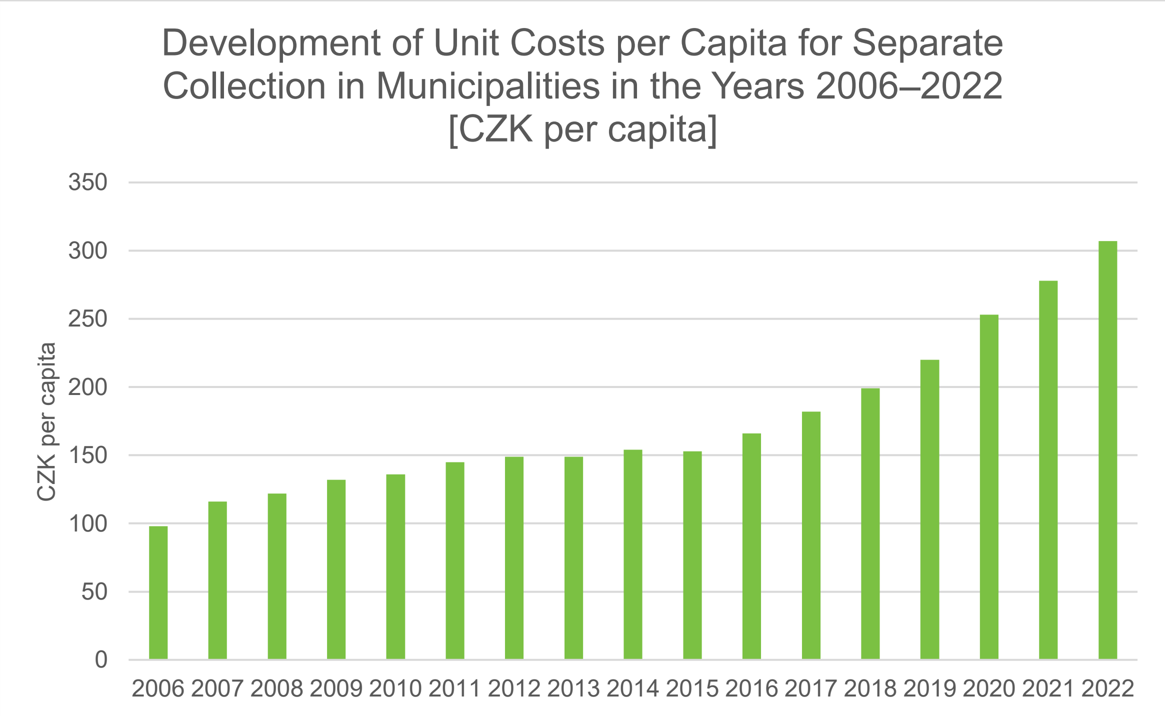
Source: processed on the basis of data of the Authorised Packaging Company

Costs of Separate Collection

The costs of separate collection of material components of municipal waste are the sum of the costs of collection and transport, and any costs associated with the handover of waste for its subsequent management for the commodities of separately collected paper, plastic, glass, beverage cartons, and metal. These costs accounted for roughly 23 % of total municipal costs in 2022 (Graph 1).

As can be seen from the following graph (Graph 4), between 2015 and 2022 unit costs recalculated per capita grew more steeply than in previous years. This is mainly due to a marked increase in the yield of separately collected waste in municipalities, especially through relatively expensive collection methods, such as public containers or containers intended for individual households (so-called door-to-door systems, i.e. individual container collections).

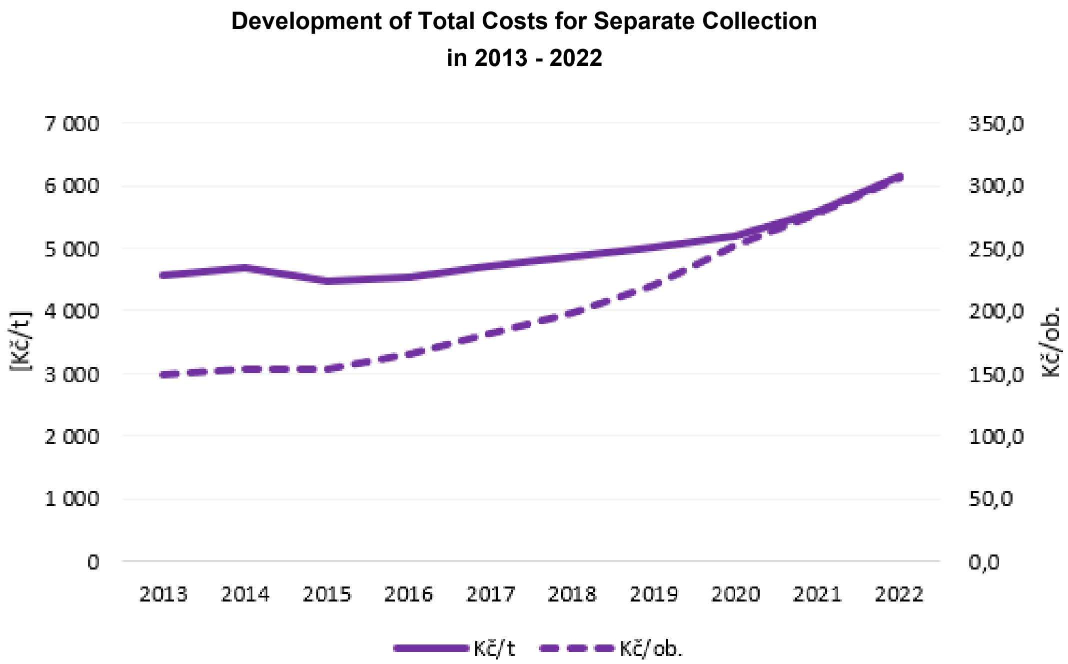
Graph 4: Development of Unit Costs per Capita for Separate Collection (paper, plastic, glass, metals, and beverage cartons) in Municipalities in the Years 2006–2022 (CZK per capita)



Source: processed on the basis of data of the Authorised Packaging Company

The actual price of waste collection and transport, i.e. unit costs recalculated per tonne of separately collected material, is not rising at such a steep pace. Since 2015, the costs of separate collection of materially recoverable waste (paper, plastic, glass, metals, and beverage cartons) per capita have been rising in an essentially linear manner (Graph 5).

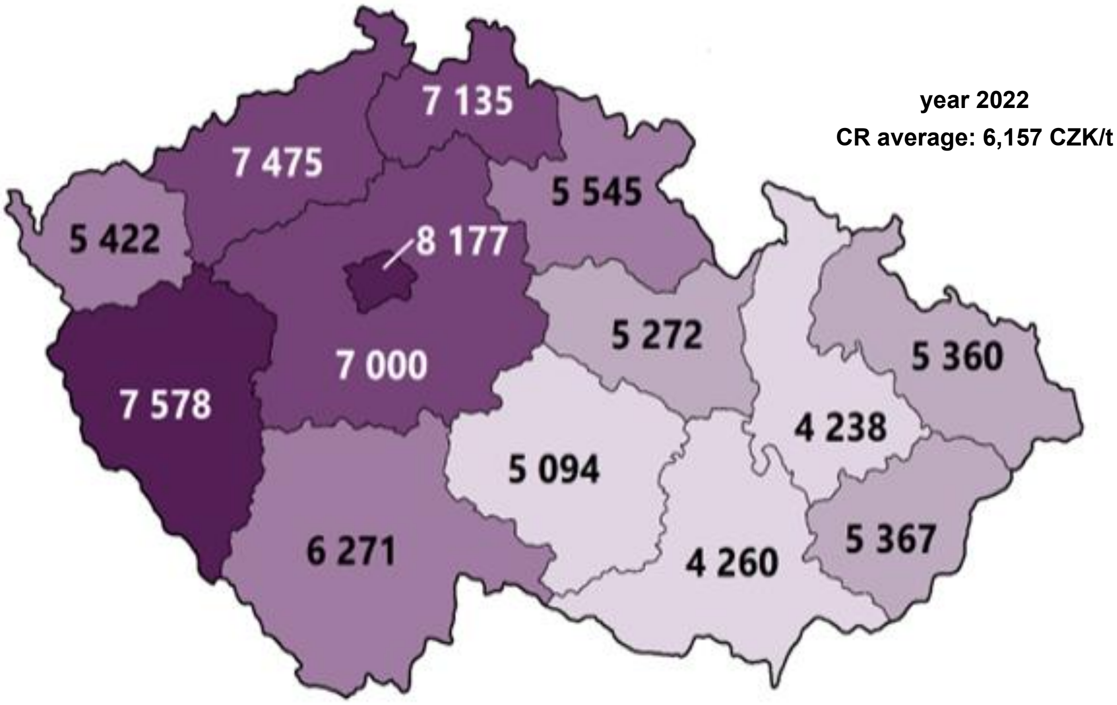
Graph 5: Comparison of the Development of Municipal Costs for Separate Collection (paper, plastic, glass, metals, and beverage cartons) Recalculated per Capita and Recalculated per Tonne of Collected Waste in the Years 2013–2022



Source: processed on the basis of data of the Authorised Packaging Company

For regional comparison, the average costs of separate collection by regions and by size groups of municipalities are also presented (Figuer2 and Table 2). The highest average costs of separate collection are in the Capital City of Prague (CZK 8,177/t), followed by the Plzeň Region (CZK 7,578/t), the Ústí nad Labem Region (CZK 7,745/t), the Liberec Region (CZK 7,135/t), and the Central Bohemian Region (CZK 7,000/t). The lowest total costs of separate collection are in the Olomouc Region (CZK 4,238/t), the South Moravian Region (CZK 4,260/t), and the Vysočina Region (CZK 5,094/t).

Figuer2: Municipal Costs for Separate Collection (paper, plastics, glass, metals, and beverage cartons) CZK/t in 2022 by Regions



Source: Authorised Packaging Company

The costs of municipal waste management are traditionally the highest in the Capital City of Prague compared to other regions of the Czech Republic, which is related to the generally higher price level in this region. Higher costs in other regions may be associated with a less developed network of sites for separate collection, the pricing policies of collection companies, population density, or the type of development in the region.

Table 2: Municipal Costs for Separate Collection (paper, plastics, glass, metals, and beverage cartons) in 2022 by Regions

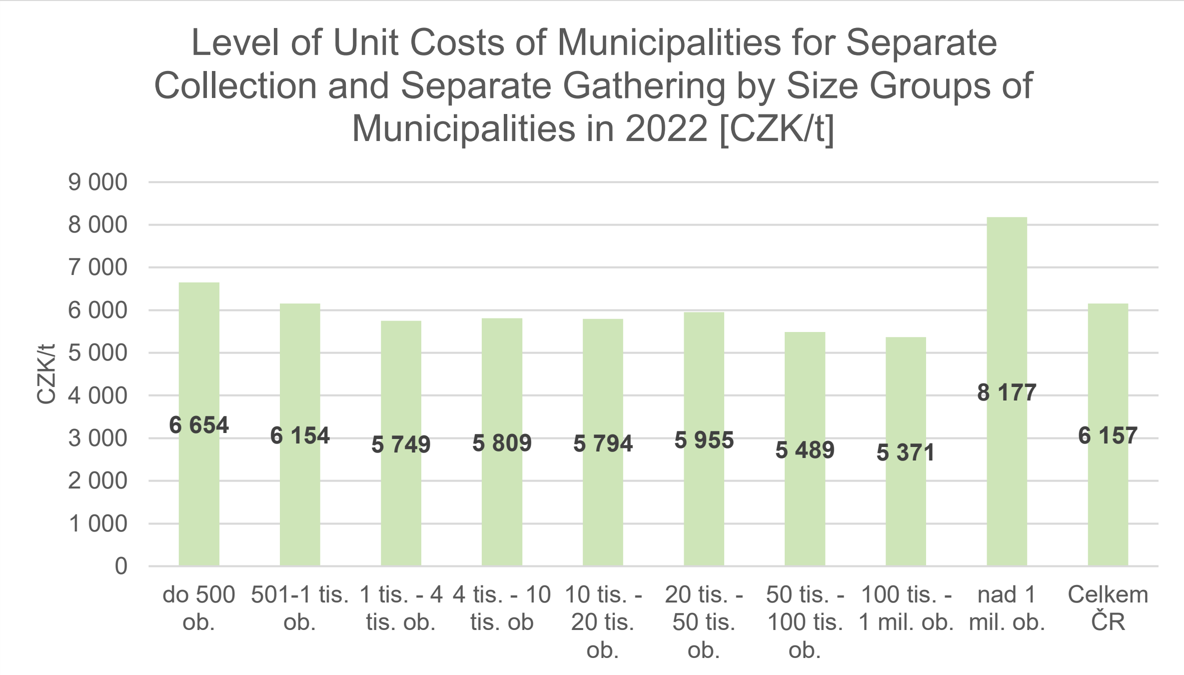
Region	Unit costs	
	CZK/t	CZK per capita
Capital City of Prague	8,177	407.1
the South Bohemian Region	6,271	308.1
South Moravian Region	4,260	195.9
Karlovy Vary Region	5,422	282.5
Hradec Králové Region	5,545	309.5

Region	Unit costs	
	CZK/t	CZK per capita
Liberec Region	7,135	340.8
Moravian-Silesian Region	5,360	251.4
Olomouc Region	4,238	219.6
Pardubice Region	5,272	270.7
Pilsen Region	7,578	389.3
Central Bohemia Region	7,000	409.6
Ústí nad Labem Region	7,475	291.7
Vysočina Region	5,094	286.5
Zlín Region	5,367	235.9
Total CR	**6,157**	**306.5**

Source: processed on the basis of data of the Authorised Packaging Company

The following graph (Graph 6) shows the level of costs for separate collection (paper, plastics, glass, metals, and beverage cartons) and its separate gathering in municipalities by size groups of municipalities in the Czech Republic. It may be seen that the level of these costs per tonne of separated waste, with the growth in the size of municipalities, generally decreases, with some exceptions. This phenomenon may be attributed to economies of scale, where it is economically more advantageous for larger municipalities to service their territory at a certain frequency, within which it is also easier to concentrate the commodities of separate collection at sites for further treatment. Smaller municipalities may often have large cadastral territories with low population density, which must be serviced, and sites for the gathering of commodities of separate collection may then need to be transported over longer distances than in the case of larger municipalities. Traditionally, the highest level of costs for separate collection and separate gathering is in the Capital City of Prague (CZK 8,177/t), where there is both the highest number of inhabitants and also the densest network of separate collection sites, which must be serviced, and a higher frequency of waste collection than in other regions.

Graph 6: Level of Unit Costs for Separate Collection and Separate Gathering (paper, plastics, glass, metals, and beverage cartons) in Municipalities by Size Groups of Municipalities, Recalculated per Tonne (CZK/t)



Source: processed on the basis of data of the Authorised Packaging Company

The following table (Table 3) shows the same situation as the graph above (Graph 6). The average price per tonne of waste within separate collection (*paper, plastics, glass, metals, and beverage cartons*) and its separate gathering was CZK 6,157 in the Czech Republic in 2022. Per capita, the average costs in 2022 were CZK 306.5.

Table 3: Municipal Costs for Separate Collection (paper, plastics, glass, metals, and beverage cartons) and Their Separate Gathering in 2022 by Size Groups of Municipalities

Region	Unit costs	
	CZK/t	CZK per capita
up to 500 inhab.	6,654	383.0
501-1 thous. inhab.	6,154	338.0
1- 4 thous. inhab.	5,749	308.7
4 - 10 thous. inhab.	5,809	313.3
10 - 20 thous. inhab.	5,794	280.8
20 - 50 thous. inhab.	5,955	262.2
50 - 100 thous. inhab.	5,489	224.2
100 thous. - 1 mil. inhab.	5,371	226.9
over 1 million inhab.	8,177	407.1
Total CR	**6,157**	**306.5**

Source: processed on the basis of data of the Authorised Packaging Company

2.1.1 Costs Related to the Fulfilment of the Objectives of the WMP

From the perspective of the cost impacts induced by activities aimed at meeting the WMP objectives on the regions, these costs can be divided into four main groups.

- **Administrative Costs**

These are costs of waste management administration, control, data analysis, etc. Costs of this type will increase in connection with growing objectives and the need to provide support.

- **Preparation of Conceptual Documents and Strategies**

These costs include the preparation of analyses, consultations with experts, negotiations and ensuring compliance with national objectives, monitoring the fulfilment of objectives and the definition of measures. Another segment is the developing cooperation with municipalities in optimising waste collection. The area of preparation and updating of emergency waste management plans in the event of natural disasters will also play an important role. For this type of costs as well, it can be expected that they will increase in the future.

- **Subsidy Resources**

Regions often provide (not only) municipalities with financial contributions for the introduction of efficient waste collection systems, composting, anaerobic digestion of biowaste or the construction of local facilities. In the future, the support of the regions in the field of collection and waste management for specific waste streams can be expected to expand. For these costs, growth can also be expected in the future.

- **Support for Waste Sorting and Recycling**

These costs include financing and co-financing of projects to increase the share of sorted waste, such as information campaigns, support for the development of the collection network and proper waste management, etc. In the future, it is to be expected that these expenditures will increase relatively significantly.

The development of the level of these costs cannot be predicted, but it can be assumed that they will grow in relation to the increasing WMP objectives.

Expected Costs in the Regions

From the perspective of predicting costs associated with waste management in individual regions, only indicative qualified estimates can be made, based on the expected and modelled development of waste generation and the costs associated with ensuring municipal waste management in line with the objectives of the WMP CR.

As follows from the analytical data of regional costs in 2022, the differences in costs for individual commodities vary greatly between regions and are influenced by a wide range of factors, such as the number of inhabitants and their standard of living in individual regions, their consumption behaviour patterns, population density, geographical conditions, transport services in the area, methods of collection and transport of commodities, availability and equipment of waste management technologies, competition among waste management companies, methods of setting prices for individual activities and methods of waste management in the field of waste management, and others. From this perspective, predicting the development of these factors, including the evolution of waste management at regional level, for the period by 2035 is almost unrealistic. For an indicative overview, a calculation was made of the projected municipal waste costs of municipalities in 2035 at the level of regions and NUTS 2 areas, based on the average population living in the regions in 2024.

The following table (Table 4) shows that the highest costs can be expected in the Capital City of Prague (up to CZK 3.6 billion) and the Central Bohemian Region (up to CZK 3.8 billion), the South Moravian Region (up to CZK 3.2 billion) and the Moravian-Silesian Region (up to CZK 3.1 billion) by 2035. Conversely, the lowest costs can be expected by 2035 in the Karlovy Vary Region (CZK 0.8 billion). It should be noted, however, that these are estimates determined on the basis of the population in these regions, and the actual cost level will be influenced by a wide range of other factors mentioned above.

Table 4: Breakdown of Scenarios of the Development of Total Municipal Waste Costs of Municipalities in Individual Regions (CZK billion)

Region	2030 (billion CZK)		2035 (billion CZK)	
	min.	max.	min.	max.
Capital City of Prague	3.2	3.2	3.5	3.6
Central Bohemia Region	3.3	3.4	3.6	3.8
the South Bohemian Region	1.5	1.5	1.6	1.7
Pilsen Region	1.4	1.4	1.5	1.6
Karlovy Vary Region	0.7	0.7	0.7	0.8
Ústí nad Labem Region	1.8	1.9	2.0	2.1
Liberec Region	1.0	1.1	1.1	1.2
Hradec Králové Region	1.3	1.3	1.4	1.4
Pardubice Region	1.2	1.2	1.3	1.4
Vysočina Region	1.2	1.2	1.3	1.3
South Moravian Region	2.8	2.9	3.1	3.2
Olomouc Region	1.4	1.5	1.6	1.6
Zlín Region	1.3	1.4	1.4	1.5
Moravian-Silesian Region	2.7	2.8	3.0	3.1

Source: Source: CSO (2024), own calculation

The following table (Table 5) shows that the highest costs are estimated in the NUTS 2 regions of Southeast (up to CZK 4.5 billion), Northeast (up to CZK 4 billion), Central Bohemia (up to CZK 3.8 billion) and Prague (up to CZK 3.6 billion) by 2035. Conversely, the lowest costs are expected in the regions of Northwest (CZK 2.9 billion), Central Moravia (CZK 3.1 billion), Moravia-Silesia (CZK 3.1 billion), and Southwest (CZK 3.3 billion). Again, it must be taken into account that these are only estimates based on the population of the given areas, and that the actual cost level will be influenced by a number of other factors mentioned above.

Table 5: Breakdown of Scenarios of the Development of Total Municipal Waste Costs of Municipalities in Individual NUTS 2 Regions (CZK billion)

NUTS 2 area	2030 (billion CZK)		2035 (billion CZK)	
	min.	max.	min.	max.
Prague	3.2	3.2	3.5	3.6
Central Bohemia	3.3	3.4	3.6	3.8
Southwest	2.9	3.0	3.2	3.3
Northwest	2.5	2.6	2.8	2.9
Northeast	3.5	3.6	3.8	4.0
Southeast	4.0	4.1	4.4	4.5
Central Moravia	2.8	2.8	3.0	3.1
Moravia-Silesia	2.7	2.8	3.0	3.1

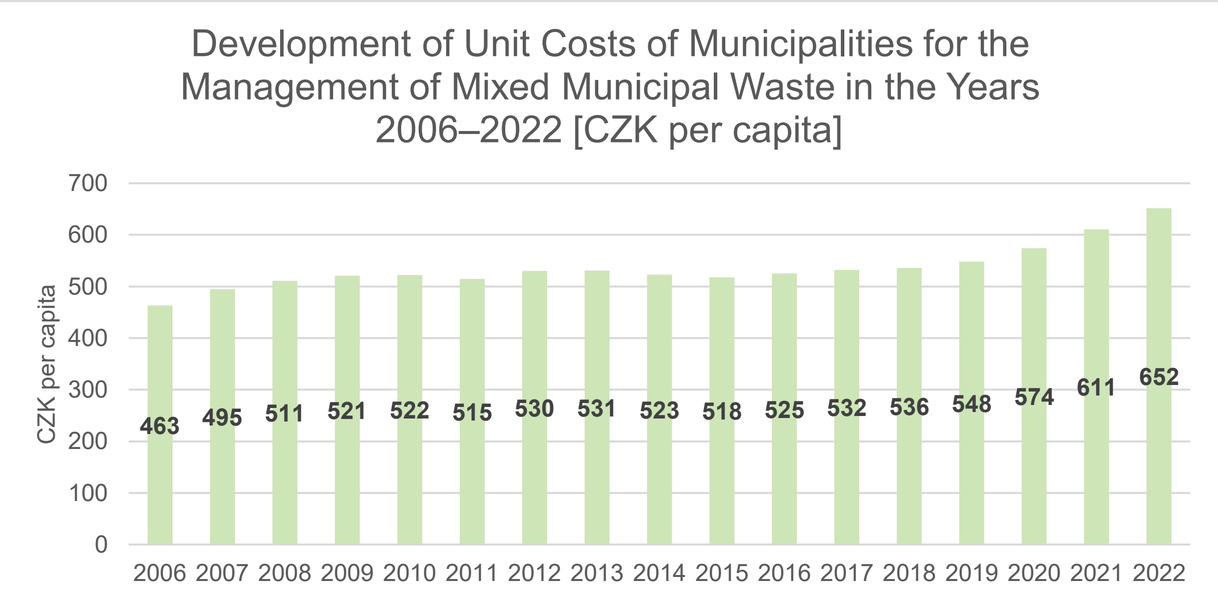
Source: Source: CSO (2024), own calculation

In the Czech Republic, there is no comprehensive system for collecting data on the costs of waste management outside the collection of data on municipal costs. For this reason, it is not possible to reliably evaluate future costs associated with waste management in other segments such as industry, construction, and other sectors to the same extent as at the municipal level. Manufacturing companies have individual contracts with waste management companies and these data are not publicly available.

2.2 Costs of Mixed Municipal Waste

The costs of mixed municipal waste constitute the largest item of municipal costs for municipal waste. These are costs associated with the collection and transport of mixed municipal waste from citizens, including costs associated with its further management (disposal by landfilling, energy recovery of waste). The evolution of these costs is shown in the following graph (Graph 7).

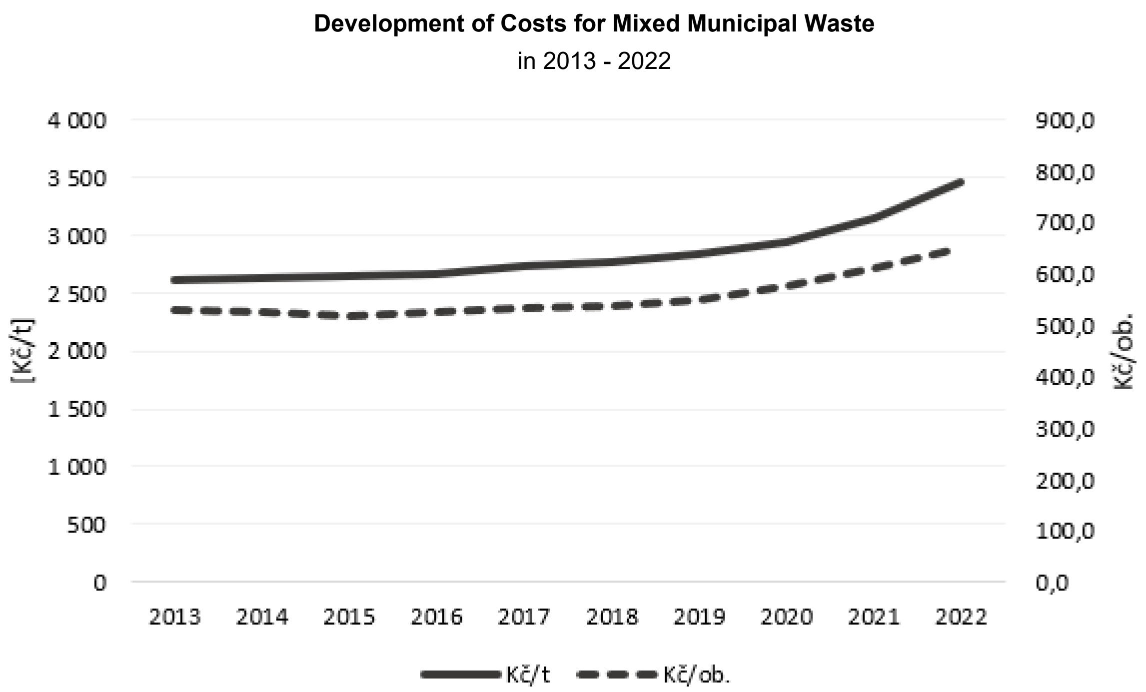
Graph 7: Development of Unit Costs for the Management of Mixed Municipal Waste within the Municipal System Recalculated per Capita (CZK per capita)



Source: processed on the basis of data of the Authorised Packaging Company

As is evident from the following graph (Graph 8), the price per tonne of mixed municipal waste is rising more steeply than the costs recalculated per capita. The reason is the gradual slight decrease in the generation of mixed municipal waste per capita in municipalities, and thus a lower weight to which the costs are related.

Graph 8: Comparison of the Development of Costs for Mixed Municipal Waste within the Municipal System Recalculated per Capita and Recalculated per Tonne of Material in the Years 2013–2022

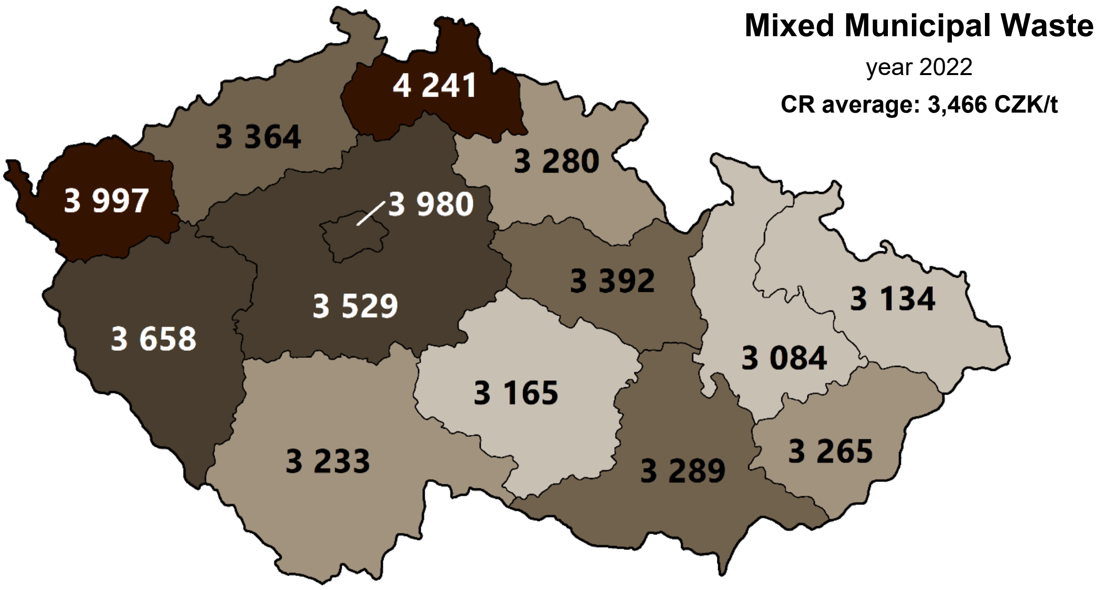


Source: processed on the basis of data of the Authorised Packaging Company

In the following tables, maps, and graphs, for comparison, the average costs of mixed municipal waste are presented by regions (Figuer3 and Table 6) and by size groups of municipalities (Graph 9 and Table 6).

From the following map (Figuer3) it is evident that the highest costs of mixed municipal waste in 2022 were in the Liberec Region (CZK 4,241/t), the Karlovy Vary Region (CZK 3,997/t), the Plzeň Region (CZK 3,658/t), the Central Bohemian Region (CZK 3,529/t), and the Capital City of Prague (CZK 3,980/t). The lowest costs of mixed municipal waste in 2022 were in the Olomouc Region (CZK 3,084/t), the Moravian-Silesian Region (CZK 3,134/t), and the Vysočina Region (CZK 3,165/t).

Figuer3: Costs of Mixed Municipal Waste within the Municipal System in CZK/t in 2022 by Regions



Source: Authorised Packaging Company

The following table (Table 6) shows the same situation as the map above (Figuer3). It is evident that in 2022 the total average costs of mixed municipal waste in the Czech Republic amounted to CZK 3,466 per tonne, which corresponds to CZK 651.6 per capita.

Table 6: Costs of Mixed Municipal Waste within the Municipal System in 2022 by Regions

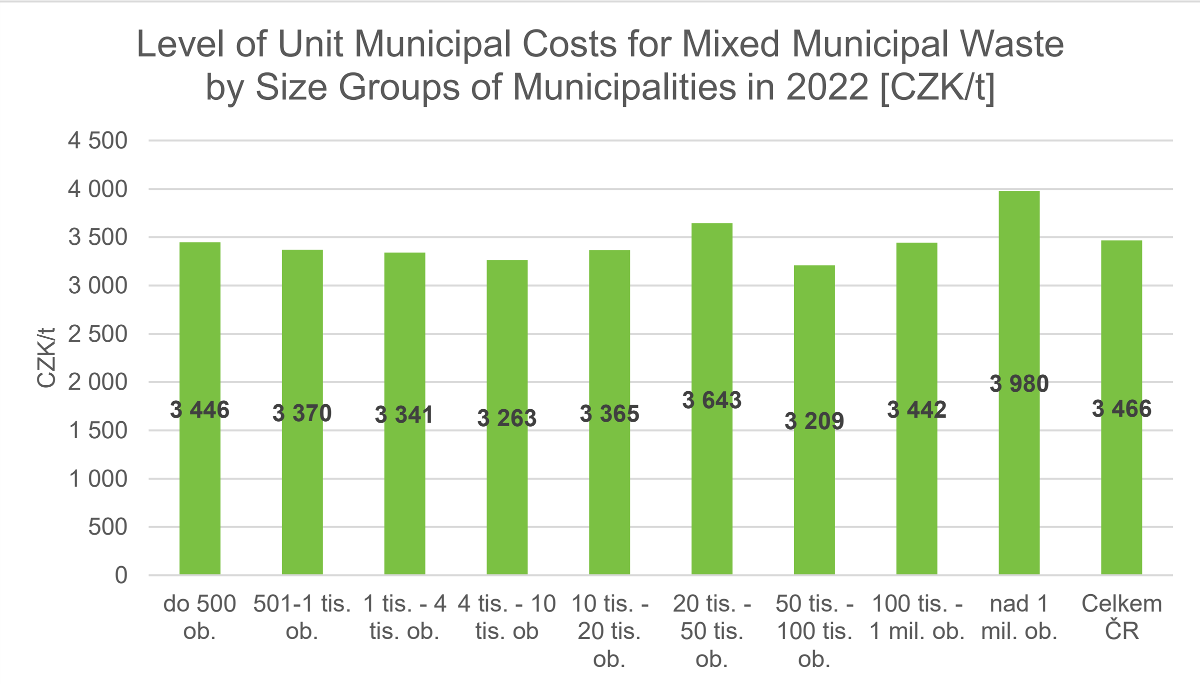
Region	Unit costs	
	CZK/t	CZK per capita
Capital City of Prague	3,980	798.9
the South Bohemian Region	3,233	658.9
South Moravian Region	3,289	570.9
Karlovy Vary Region	3,997	741.0
Hradec Králové Region	3,280	582.4
Liberec Region	4,241	766.7
Moravian-Silesian Region	3,134	553.9
Olomouc Region	3,084	561.1
Pardubice Region	3,392	580.9
Pilsen Region	3,658	681.2
Central Bohemia Region	3,529	748.2
Ústí nad Labem Region	3,364	685.9
Vysočina Region	3,165	558.9
Zlín Region	3,265	543.2

Region	Unit costs	
	CZK/t	CZK per capita
Total CR	**3,466**	**651.6**

Source: processed on the basis of data of the Authorised Packaging Company

The following graph (Graph 9) shows the level of unit municipal costs for mixed municipal waste in the size groups of municipalities of the Czech Republic in 2022. It may be seen that the level of costs for mixed municipal waste is similar across all size groups of municipalities, from municipalities with up to 500 inhabitants to municipalities with 100,000 to 1 million inhabitants. In 2022, costs were slightly higher in municipalities with 20,000 to 50,000 inhabitants (CZK 3,643/t), while traditionally the highest costs for mixed municipal waste in 2022 were in the Capital City of Prague (CZK 3,980/t).

Graph 9: Level of Unit Municipal Costs for Mixed Municipal Waste within the Municipal System by Size Groups of Municipalities in 2022, Recalculated per Tonne (CZK/t)



Source: processed on the basis of data of the Authorised Packaging Company

The following table (Table 7) shows the same data as the graph above (Graph 9), while also presenting the average costs of mixed municipal waste per capita in the size groups of municipalities in 2022. According to the table, the highest costs of mixed municipal waste are in municipalities with over 1 million inhabitants (CZK 798.9 per capita), i.e. the Capital City of Prague, and in municipalities with up to 500 inhabitants (CZK 703.2 per capita). In the other size groups of municipalities, the costs of mixed municipal waste per capita vary considerably and depend on population density, type of development in the region, the costs of collection companies in the given areas, and other factors.

Table 7: Costs of Mixed Municipal Waste within the Municipal System in 2022 by Size Groups of Municipalities

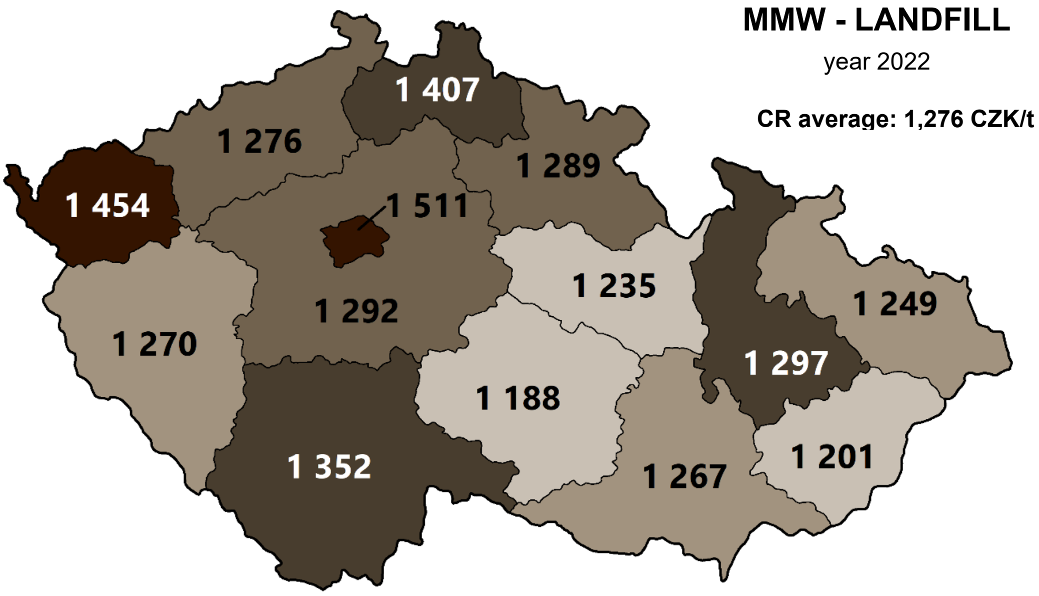
Region	Unit costs	
	CZK/t	CZK per capita
up to 500 inhab.	3,446	703.2
501-1 thous. inhab.	3,370	665.8
1- 4 thous. inhab.	3,341	618.6
4 - 10 thous. inhab.	3,263	615.5
10 - 20 thous. inhab.	3,365	629.0
20 - 50 thous. inhab.	3,643	640.3
50 - 100 thous. inhab.	3,209	597.7
100 thous. - 1 mil. inhab.	3,442	603.5
over 1 million ob.	3,980	798.9
Total CR	**3,466**	**651.6**

Source: processed on the basis of data of the Authorised Packaging Company

On average, just under 40 % of the costs of mixed municipal waste within the municipal system consist of costs of the disposal of mixed municipal waste by landfilling. In 2022, the nationwide value reached CZK 1,276 per tonne of waste disposed of in a landfill. In the following map (Figuer4) shows the regional variation in this indicator.

The highest costs of the disposal of mixed municipal waste in 2022 were in the Capital City of Prague (CZK 1,511/t) and the Karlovy Vary Region (CZK 1,454/t). The lowest costs of the disposal of mixed municipal waste in 2022 were in the Vysočina Region (CZK 1,188/t), the Zlín Region (CZK 1,201/t), and the Pardubice Region (CZK 1,235/t).

Figuer4: Costs of the Disposal of Mixed Municipal Waste within the Municipal System by Landfilling in CZK/t in 2022 by Regions



Source: Authorised Packaging Company

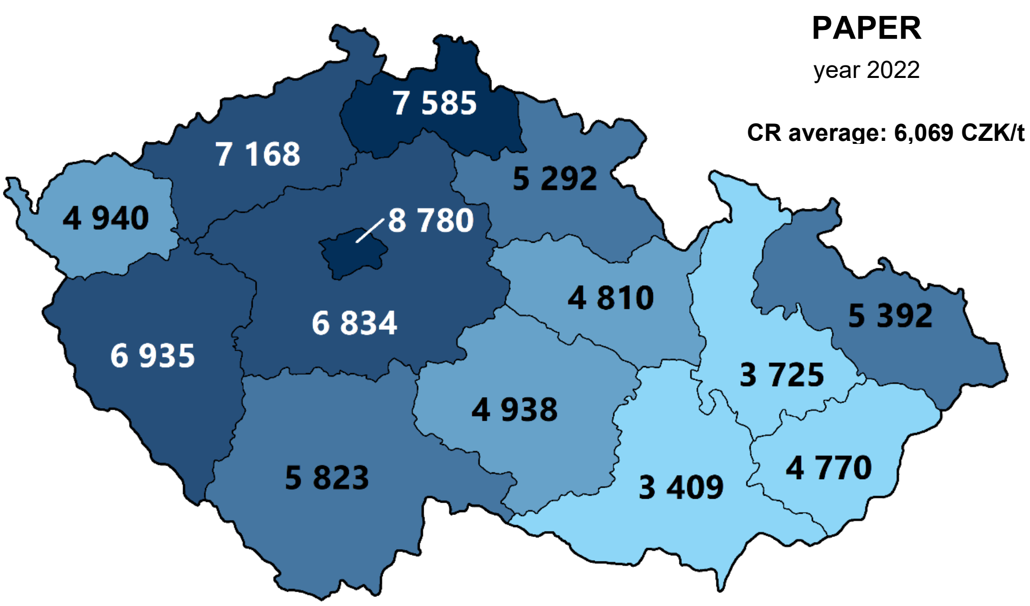
2.3 Costs by Individual Commodities

As part of the survey of the Authorised Packaging Company, costs of individual separated commodities are also monitored. In 2022, the level of costs for the collection and transport of paper was CZK 6,069 per tonne of waste, the costs for plastics amounted to CZK 9,422 per tonne, and the costs for glass were CZK 2,018 per tonne of waste.

Regional differences are shown in the maps with costs by the territories of individual regions in the following maps.

From the following map (Figure5) it is evident that the highest costs of separate collection of paper in 2022 were in the Capital City of Prague (CZK 8,780/t), the Liberec Region (CZK 7,585/t), and the Ústí nad Labem Region (CZK 7,168/t). Conversely, the lowest costs of separate collection of paper in 2022 were in the South Moravian Region (CZK 3,409/t), the Olomouc Region (CZK 3,752/t), and the Zlín Region (CZK 4,770/t).

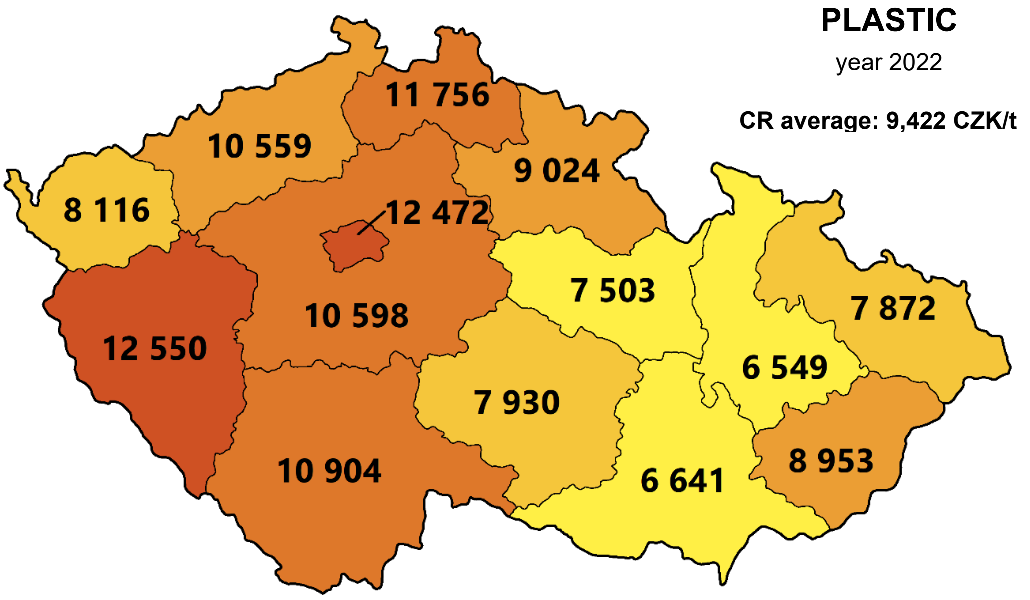
Figure5: Costs of the Collection and Transport of Paper within Separate Collection in Municipalities in CZK/t in 2022 by Regions



Source: Authorised Packaging Company

The following map (Figure6) shows the costs of separate collection of plastics in 2022. The highest costs in 2022 were in the Plzeň Region (CZK 12,550/t), the Capital City of Prague (CZK 12,472/t), and the Liberec Region (CZK 11,756/t). Conversely, the lowest costs of separate collection of plastics in 2022 were in the Olomouc Region (CZK 6,549/t), the South Moravian Region (CZK 6,641/t), and the Pardubice Region (CZK 7,503/t).

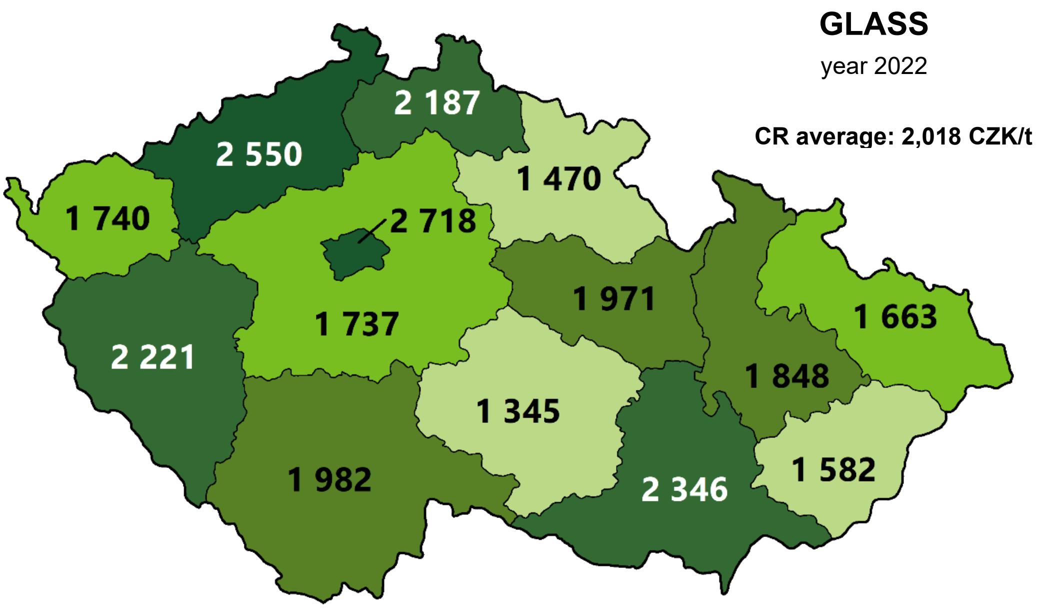
Figure6: Costs of Plastics within Separate Collection in Municipalities in CZK/t in 2022 by Regions



Source: Authorised Packaging Company

The last map (Figuer7) shows the average costs of the collection and transport of glass in 2022 in the Czech Republic. It is evident that in that year the highest costs of the collection and transport of glass were in the Capital City of Prague (CZK 2,718/t), followed by the Ústí nad Labem Region (CZK 2,550/t), the South Moravian Region (CZK 2,346/t), the Plzeň Region (CZK 2,221/t), and the Liberec Region (CZK 2,187/t). Conversely, the lowest costs of the collection and transport of glass in 2022 were in the Vysočina Region (CZK 1,345/t), the Hradec Králové Region (CZK 1,470/t), and the Zlín Region (CZK 1,582/t).

Figuer7: Costs of Glass within Separate Collection in Municipalities in CZK/t in 2022 by Regions



Source: Authorised Packaging Company

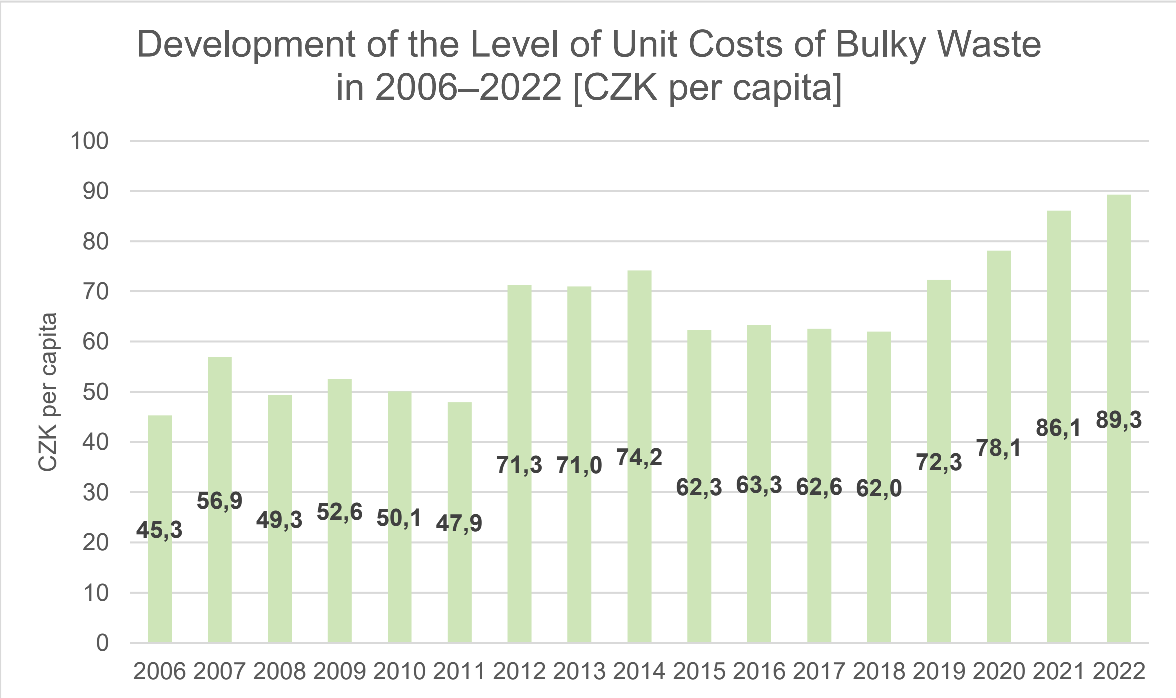
From the data it can be observed that, on average, the costs of paper and plastics are higher in Bohemia than in Moravia. The costs of glass are distributed more evenly.

Costs of Bulky Waste

Another significant item of the total costs of municipal waste of municipalities is the costs of bulky waste. These are costs associated with the collection and transport of bulky waste from citizens, by all collection methods – mobile collection, collection through collection yards and collection points, and other collection methods, including costs associated with its further management.

The unit costs per capita reached CZK 89.3 per capita in 2022. The development of this indicator since 2006 is shown in the following graph (Graph 10).

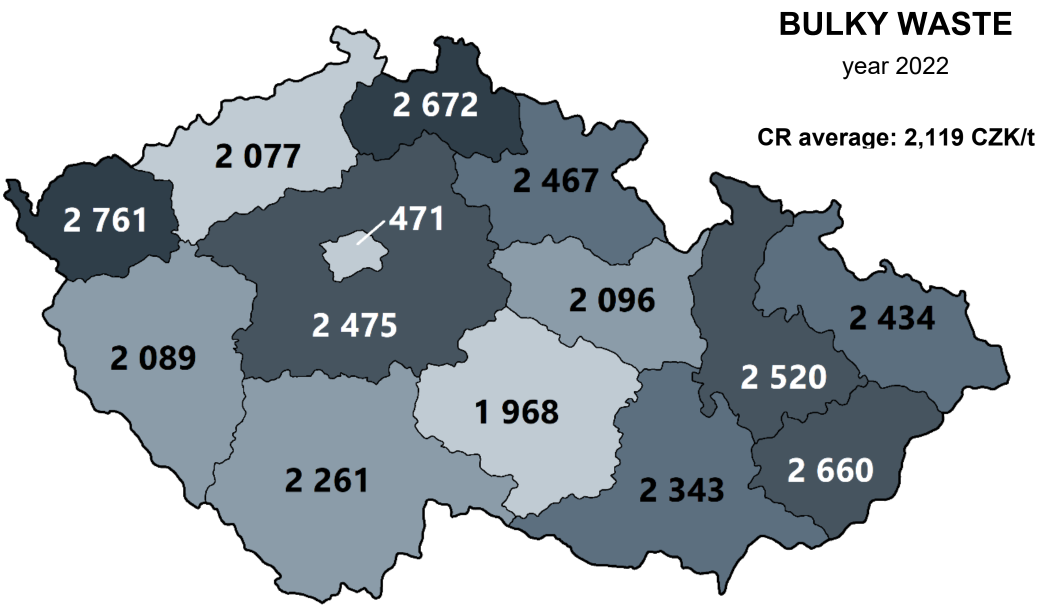
Graph 10: Development of the Level of Unit Costs of Bulky Waste Originating from the Municipal System, Recalculated per Capita (CZK per capita)



Source: processed on the basis of data of the Authorised Packaging Company

For comparison purposes, the costs of the management of bulky waste originating from the municipal system are further broken down by regions (Figure8 and Table 8) and by size groups of municipalities (Graph 11 and Table 6). From the map it follows that the highest costs of bulky waste are in the Karlovy Vary Region (CZK 2,761/t), the Liberec Region (CZK 2,672/t), the Zlín Region (CZK 2,660/t), the Olomouc Region (CZK 2,520/t), and the Central Bohemian Region (CZK 2,475/t). The lowest costs are in the Capital City of Prague (CZK 471/t).

Figure8: Costs of Bulky Waste Originating from the Municipal System in CZK/t in 2022 by Regions



Source: Authorised Packaging Company

The following table (Table 8) shows the same situation as the graph above (Graph 10). It is, however, evident that the average total costs of bulky waste in the Czech Republic in 2022 amounted to CZK 2,119 per tonne, which corresponds to CZK 89.3 per capita. The average figure per capita may be distorted by the very low costs of bulky waste in the Capital City of Prague, where in 2022 the costs of bulky waste amounted to CZK 15.4 per capita. The highest costs of bulky waste in 2022 were in the Karlovy Vary Region (CZK 155.1 per capita) the Liberec Region (CZK 124.8 per capita), the Ústí nad Labem Region (CZK 122.8 per capita), the Zlín Region (CZK 119.8 per capita), the Moravian-Silesian Region (CZK 118.8 per capita), the Central Bohemian Region (CZK 105.0 per capita), and the South Moravian Region (CZK 100.9 per capita).

Table 8: Costs of Bulky Waste Originating from the Municipal System in 2022 by Regions

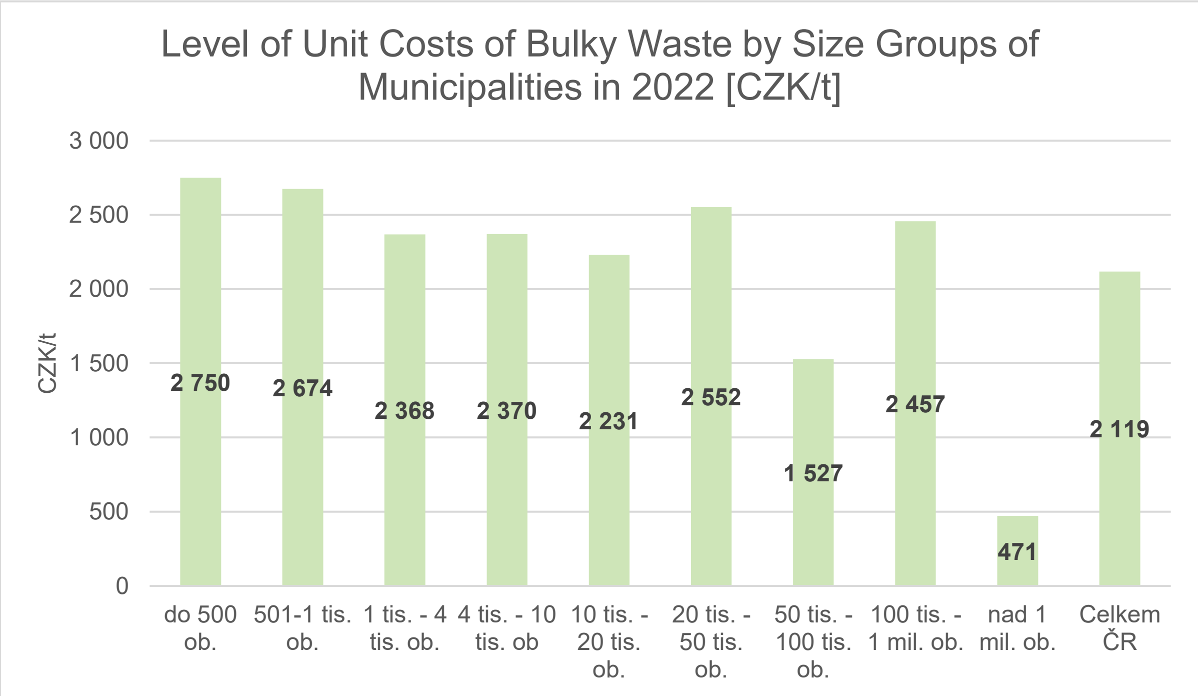
Region	Unit costs	
	CZK/t	CZK per capita
Capital City of Prague	471	15.4
the South Bohemian Region	2,261	88.3
South Moravian Region	2,343	100.9
Karlovy Vary Region	2,761	155.1
Hradec Králové Region	2,467	89.6
Liberec Region	2,672	124.8
Moravian-Silesian Region	2,434	118.8
Olomouc Region	2,520	87.3
Pardubice Region	2,096	68.7
Pilsen Region	2,089	83.7

Central Bohemia Region	2,475	105.0
Ústí nad Labem Region	2,077	122.8
Vysočina Region	1,968	76.6
Zlín Region	2,660	119.8
Total CR	**2,119**	**89.3**

Source: processed on the basis of data of the Authorised Packaging Company

In the following graph (Graph 11) shows the level of unit costs of bulky waste in 2022 is shown by size groups of municipalities in the Czech Republic. It can be seen that the level of unit costs of bulky waste more or less gradually decreases from municipalities in the category up to 500 inhabitants (CZK 2,750/t) down to the category of municipalities with 10,000 to 20,000 inhabitants (CZK 2,231/t). In municipalities in the category of 20,000 to 50,000 inhabitants (CZK 2,552/t) and in municipalities with 100,000 to 1 million inhabitants (CZK 2,457/t), the unit costs of bulky waste are again higher. The lowest unit costs of bulky waste in 2022 were in the Capital City of Prague (CZK 471/t) and in municipalities with 50,000 to 100,000 inhabitants (CZK 1,527/t).

Graph 11: Level of Unit Costs of Bulky Waste Originating from the Municipal System by Size Groups of Municipalities, Recalculated per Tonne (CZK/t)



Source: processed on the basis of data of the Authorised Packaging Company

The following table (Table 9) shows the same situation as the graph above (Graph 11). It can further be seen from it that the highest costs of bulky waste per capita in 2022 were in municipalities in the category of 20,000 to 50,000 inhabitants (CZK 139.9 per capita), followed by municipalities with 10,000 to 20,000 inhabitants (CZK 116.5 per capita) and municipalities with 4,000 to 10,000 inhabitants (CZK 113 per capita). The lowest unit costs were then in the Capital City of Prague (CZK 15.4 per capita) and in municipalities with 50,000 to 100,000 inhabitants (CZK 66.0 per capita).

Table 9: Unit Costs of Bulky Waste Originating from the Municipal System in 2022 by Size Groups of Municipalities

Size group	Unit costs	
	CZK/t	CZK per capita
up to 500 inhab.	2,750	87.1
501-1 thous. inhab.	2,674	80.7
1- 4 thous. inhab.	2,368	97.3
4 - 10 thous. inhab.	2,370	113.0
10 - 20 thous. inhab.	2,321	116.5
20 - 50 thous. inhab.	2,552	139.9
50 - 100 thous. inhab.	1,527	66.0
100 thous. - 1 mil. inhab.	2,457	103.1
over 1 million ob.	471	15.4
Total CR	**2,119**	**89.3**

Source: processed on the basis of data of the Authorised Packaging Company

2.4 Summary Overview of Costs of Municipal Waste

The following table (Table 10) presents the annual summary overview of selected costs of the management of municipal waste within municipal systems. It should be noted that the costs of collection yards, the costs of waste deposited outside designated sites[2] and the costs of waste from municipal green maintenance are determined only for a sample of municipalities with valid data. Therefore, they cannot be added to the other items, and the total costs are not a simple sum of the individual items.

Table 10: Summary Overview of the Development of Selected Unit Costs of Municipalities with Municipal Waste in CZK per capita

Year	Unit Costs [CZK per capita]						
	mixed waste	bulky waste	separate collection (paper, plastics, glass, metal, beverage carton)	collection yards[1,3]	illegal dumps[1]	biodegradable waste (from citizens) + waste from municipal green maintenance[1]	total costs[2]
2006	463.2	45.3	98.4	56.2	11.8	x	697.9
2007	494.8	56.9	116.4	65.0	8.7	x	765.2
2008	511.1	49.3	121.6	88.0	12.5	x	803.0
2009	521.0	52.6	132.3	86.2	11.0	80.7	849.3
2010	522.0	50.1	136.2	89.4	11.1	71.1	868.2
2011	515.0	47.9	145.2	98.3	9.9	72.0	912.0
2012	529.5	71.3	149.0	93.2	10.0	50.7	902.7
2013	531.3	71.0	149.1	80.0	6.7	49.6	889.7
2014	523.3	74.2	153.7	86.8	8.9	55.7	911.4
2015	518.3	62.3	153.2	105.5	7.9	66.6	870.5
2016	524.7	63.3	166.1	102.4	8.0	72.6	900.0
2017	532.3	62.6	182.2	106.7	8.4	74.7	937.0
2018	535.6	62.0	199.1	118.2	12.2	76.3	978.1
2019	547.5	72.3	220.3	132.6	10.7	82.9	1,031.7
2020	573.9	78.1	252.6	144.6	10.6	87.2	1,063.8
2021	611.0	86.1	277.8	158.7	12.2	98.1	1,166.9
2022	651.6	89.3	306.5	109.0	10.2	112.6	1,318.6

[1] items are determined only for a valid sample of municipalities. The data shown are according to the definition from the AOS EKO-KOM questionnaire

[2] is not a simple sum of the items

[3] change of methodology of data collection since 2022

Source: processed on the basis of data of the Authorised Packaging Company

The growth of unit costs associated with municipal waste increases the burden on household budgets. For the comparison of the burden on household budgets, the development of average net annual income per person and the average annual costs of municipalities with municipal waste per person were compared. This comparison is presented in the following table (*Table 11*).

Table 11: Comparison of the Development of Average Annual Income per Person and Average Annual Costs of Municipalities with Municipal Waste per Person

Year	Average Annual Income per Person (CZK/person) – Net Monetary Income	Total Costs of Municipalities for Municipal Waste (CZK per capita)	Share of Waste Costs per Citizen in Relation to Average Annual Income per Person (%)
2015	164,852	870.5	0.53
2016	172,173	900.0	0.52
2017	182,443	937.0	0.51
2018	195,071	978.1	0.50
2019	209,754	1,031.7	0.49
2020	220,106	1,063.8	0.48
2021	241,160	1,166.9	0.48
2022	259,850	1,318.6	0.51

Source: processed on the basis of data of the Authorised Packaging Company and the Czech Statistical Office – Household Living Conditions

From the table it follows that, for the management of municipal waste, the average household spends around half a percent of its net annual income.

For comparison, a table with data of the Czech Statistical Office on household final consumption expenditure by purpose in the Czech Republic is also presented.

Table*12*: *Household Final Consumption Expenditure by Purpose in the Czech Republic (%)*

	2015	2016	2017	2018	2019	2020	2021	2022	2023
4000 Housing, water, fuel	29.7	29.7	29.7	30.3	30.5	33.9	34.1	33.2	33.1
4400 Other services related to housing	1.8	1.7	1.7	1.7	1.6	1.7	1.8	1.6	1.6
4500 Electricity, heat, gas, fuel	7.8	7.6	7.2	6.6	6.2	6.5	6.5	6.9	7.0

Source: Household Final Consumption Expenditure by Purpose in the Czech Republic (according to the COICOP classification) (CZSO, 2023)

From Table 12 it follows that the share of expenditure on electricity, heat, gas, and fuels represented around 6–8 % of household final consumption expenditure in the years 2015–2023. Waste can be classified under the group Other Services Related to Housing.

The following table shows the impact of the co-financing of municipal systems by the Authorised Packaging Company for ensuring the take-back of packaging waste. This table also expresses the impact on the citizen.

Table13: The Importance of the Co-Financing of Municipal Systems by the Authorised Packaging Company for Ensuring the Take-Back of Packaging Waste and Its Impact on Citizens

Year	Average Annual Income per Person (CZK) – Net Monetary Income *	Total Costs of Municipalities for Municipal Waste (CZK per capita) **	Average Income of Municipalities from the Authorised Packaging Company (CZK per capita)	Average Costs after Deduction of Income from the Authorised Packaging Company (CZK per capita)	Share of Waste Costs Reduced by the Contribution of the Authorised Packaging Company per Citizen in Relation to Average Annual Income per Person (%)
2015	164,852	870.5	105.4	765.1	0.46
2016	172,173	900	112.1	787.9	0.46
2017	182,443	937	121	816	0.45
2018	195,071	978.1	121	857.1	0.44
2019	209,754	1031.7	138	893.7	0.43
2020	220,106	1063.8	148	915.8	0.42
2021	241,160	1166.9	169.5	997.4	0.41
2022	259,850	1318.6	180.8	1137.8	0.44

Source: *CZSO – Household Living Conditions, **Authorised Packaging Company – Proceedings from the Waste and Municipalities Conferences

The share of financing by the Authorised Packaging Company reduces the costs of municipalities with municipal waste by 12–14.5 %, which translates into a reduction of the overall burden on citizens through direct costs of municipal waste management. As follows from the table, these reduced costs represent 0.41–0.46 % of the average total net income per capita.

In the following table (*Table 14*), a comparison is presented between the year-on-year growth of net household income recalculated per citizen and the year-on-year growth of municipal expenditure on municipal waste recalculated per citizen.

Table*14*: *Comparison of the Development of Average Annual Income per Person and Average Annual Costs of Municipalities with Municipal Waste per Citizen (%)*

Period	Year-on-Year Growth of Net Household Income Recalculated per Citizen (%)	Year-on-Year Growth of Municipal Expenditure on Municipal Waste Recalculated per Citizen (%)
2015 – 2016	4	3
2016 – 2017	6	4
2017 – 2018	7	4
2018 – 2019	8	5
2019 – 2020	5	3
2020 – 2021	10	10
2021 – 2022	8	13

Source: own calculation

During the period 2015–2022, the average net household income recalculated per person increased by 58 %, while the average expenditure of municipalities on municipal waste recalculated per capita increased over the same period by 51 %. If we consider the period of the last five recorded years, i.e. 2018 to 2022, in this period the average net household income recalculated per person increased by 33 %, while the average expenditure of municipalities on municipal waste recalculated per capita increased over the same period by 35 %.

Average expenditure on waste management in the assessed period 2015–2022 has been growing more slowly than the average household income. It can therefore be stated that the share of household expenditure on these services stagnated or slightly decreased.

Over the past ten years, the total costs of municipalities with municipal waste have increased by just under 50 %. The most dynamic growth has been recorded in the costs associated with separate collection and the separate gathering of recoverable components of municipal waste (paper, plastics, glass, metals, and beverage cartons). These costs have increased by more than 100 % over the past ten years.

2.5 Costs of the Collection and Transport of Municipal Waste

Evaluation of Transport Costs (Prices for the Collection and Transport of Waste)

The evaluation of costs associated with the collection and transport of waste can be carried out for waste holders for whom relevant data exist, or where data are known from consultations with individual facilities. As mentioned above, detailed data on costs are systematically collected only for waste holders of the type of municipality.

Information on the costs of collection and transport is not collected separately anywhere and can therefore only be calculated for waste streams for which data are available on prices at final facilities, or for commodities for which the price at entry (the so-called gate fee) can be reasonably estimated.

From the previous chapter it follows that the average costs of collection and transport of mixed municipal waste can be very well calculated thanks to data on the costs associated with final management of mixed municipal waste. Less precise results are obtained when calculating the costs of collection and transport for commodities that are separately gathered and undergo subsequent sorting and treatment processes. The estimated gate fee can therefore be determined on the basis of consultations with final facilities and their clients.

The average calculated costs of collection and transport are presented in the following tables.

Mixed Municipal Waste

For the calculation of costs associated with the collection and transport of municipal waste, data on the average figures of municipalities managing mixed municipal waste were used, from which the average costs of landfilling mixed municipal waste were deducted, since landfilling remains the dominant method of managing mixed municipal waste.

Table 15: Calculation of Average Costs of Collection and Transport of Mixed Municipal Waste (CZK/t)

Items	2021	2022	2023
Average Costs of Municipalities with Mixed Municipal Waste*	3,150	3,466	3,889
Average Costs of Landfilling Mixed Municipal Waste (Gate Fee)*	1,254	1,276	1,657
Calculated Average Costs of Municipalities Associated with the Collection and Transport of Mixed Municipal	1,896	2,190	2,232

Data source: * Authorised Packaging Company – Waste Management Economics in 2021, 2022, 2023

From the table above (Table 15) it follows that, in the assessed period, the average costs of municipalities with mixed municipal waste increased by 10 % in the period 2021–2022 and by 12 % in the comparison of the years 2022–2023. The total growth of costs of mixed municipal waste between 2021 and 2023 amounted to 23 %.

The average costs of municipalities for landfilling in the assessed years increased by 32 %, while the landfill fee rate for recoverable waste rose year-on-year by CZK 100/t (2021 – CZK 800/t, 2022 – CZK 900/t, 2023 – CZK 1,000/t). The fee rate for landfilling residual waste **remained at CZK 500/t.** The growth of average costs of landfilling amounted to 2 % in the period 2021–2022 and 30 % in the comparison of 2022–2023.

By calculation, the estimated average costs associated with the collection and transport of mixed municipal waste were determined. Their growth amounted to 16 % in the period 2021–2022 and 2 % in the comparison of 2022–2023. In total, therefore, the average calculated costs of the collection and transport of mixed municipal waste increased by 18 % in the period 2021–2023.

In the assessed period of the last three years 2021–2023, the average costs of collection and transport represented 57–63 % of the total costs associated with the management of mixed municipal waste from municipalities.

The costs associated with the collection and transport of commodities of separate gathering (paper, plastics, glass) are derived from the costs recorded by municipalities after deducting the costs associated with handing over the separated components to treatment and sorting technologies. Data on the costs associated with handing over waste to technologies for their treatment or recycling are not monitored separately. These data can only be obtained through individual consultations with final facilities and their customers. It is precisely in the costs associated with handing over to final treatment or recycling technologies that large differences are recorded, caused primarily by the efficiency of operation of the given technology and the strategy of the company operating the facility. For the purposes of theoretical average calculations of the costs of collection and transport, information on the average entry prices at facilities treating and processing separately gathered waste was used.

Plastics

From the table below (Table 16) it follows that, in the assessed period, the average costs of municipalities with separate collection and gathering of plastics increased by 6 % in the period 2021–2022 and by 8 % in the comparison of 2022–2023. The total growth between 2021 and 2023 amounted to 14 %.

Table 16: Calculation of Average Costs of Separate Gathering and Transport – Plastics (CZK/t)

Items	2021	2022	2023
Average costs of municipalities with plastics*	8,875	9,422	10,156
Estimated average costs of plastics sorting (gate fee)**	2,200	2,550	2,700
Calculated average costs of municipalities associated with the collection and transport of plastics	6,675	6,872	7,456

Data source: * Authorised Packaging Company – Waste Management Economics in 2021, 2022, 2023

** Individual consultations with final facilities and their customers

The average estimated costs of municipalities for the handover of separated plastic waste to treatment and processing technologies are negative, i.e. municipalities always pay for the delivery of plastics to the sorting line. The development of the level of payments depends on the price of produced secondary raw materials, the contributions of the Authorised Packaging System, but also on the efficiency of the sorting line and operating costs, primarily in relation to energy and labour costs. The price is extremely dependent on the development of the secondary raw material market.

The average estimated costs of municipalities for the handover of separated plastic waste to treatment and sorting technologies increased by 23 % between 2021 and 2023.

By calculation, the estimated average costs associated with the collection and transport of separately gathered plastic waste were determined. Their growth amounted to 3 % in the period 2021–2022 and 8 % in the comparison of 2022–2023. In total, therefore, the average estimated calculated costs of the collection and transport of separately gathered plastic waste increased in the period between 2021 and 2023 by 12 %.

In the assessed period of the last three years 2021–2023, the average costs of the separate gathering and transport of plastic waste represented 73–75 % of the costs associated with the management of separately gathered plastic waste within the municipal system.

Paper

From the table below (Table 17) it follows that, in the assessed period, the average costs of municipalities with the separate gathering of paper waste through container and bag collection increased by 14 % in the period 2021–2022 and by 9 % in the comparison of 2022–2023. The total growth in the period 2021 to 2023 amounted to 24 %.

Table 17: Calculation of Average Costs of Collection and Transport – Paper (CZK/t)

Items	2021	2022	2023
Average Costs of Municipalities with Paper*	5,327	6,069	6,612
Estimated average costs of glass sorting (gate fee)**	-800	100	-300
Calculated Average Costs of Municipalities Associated with the Collection and Transport of Paper	6,127	5,969	6,912

Data source: * Authorised Packaging Company – Waste Management Economics in 2021, 2022, 2023

** Individual consultations with final facilities and their customers (a negative value represents the purchase price, i.e. the processor pays for the delivered waste)

The average estimated costs of municipalities for the handover of separated paper waste to treatment and processing technologies are extremely dependent on the development of prices on the secondary raw material market. At the turn of 2022 and 2023, there was a crisis in the sales of paper, and the handover prices climbed above CZK 1,000/t. Ordinarily, purchasers take separated paper at positive prices, i.e. they pay for deliveries.

By calculation, the estimated average costs associated with collection and transport were determined. The average estimated calculated costs of collection and transport increased in the period between 2021 and 2023 by 13 %.

In the assessed period 2021–2023, the average costs of separate gathering and transport represented entirely dominant costs associated with the management of separately collected paper waste. The price of the secondary raw material on the market has a major influence on the total costs charged to municipalities for ensuring the management of separately collected paper waste.

Glass

From the table above (Table 18) it follows that, in the evaluated period, the average costs of municipalities for the separate collection of glass waste increased by 4 % in the period 2021–2022 and by 14 % in the comparison of 2022–2023. The total increase between 2021 and 2023 amounted to 18 %.

Table 18: Calculation of average costs of collection and transport – glass (CZK/t)

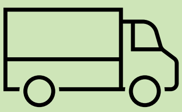
Items	2021	2022	2023
Average Costs of Municipalities with Glass*	1,948	2,018	2,294
Estimated average costs of glass sorting (gate fee)**	-500	-500	-700
Calculated Average Costs of Municipalities Associated with the Collection and Transport of Glass	2,448	2,518	2,994

Data source: * Authorised Packaging Company – Waste Management Economics in 2021, 2022, 2023

** Individual consultations with final facilities and their customers (a negative value represents the purchase price, i.e. the processor pays for the delivered waste)

The average anticipated costs of municipalities associated with the transfer of separated glass waste to treatment technologies depend on the development of prices on the secondary raw materials market. In 2023, a significant increase in purchase prices occurred on the market. Buyers purchase separated glass at positive prices, that is, they pay for deliveries of separately collected glass.

The anticipated average costs associated with the collection and transport of separately collected glass were determined by calculation. The average anticipated calculated costs of collection and transport of separately collected glass increased by 22 % between 2021 and 2022.



The costs associated with the collection and transport of municipal waste represent a significant item of municipal costs within the system.

For the assessed waste streams, the costs associated with the collection and transport of such waste within the municipal system always represent the dominant part of the total municipal costs related to the given commodity.

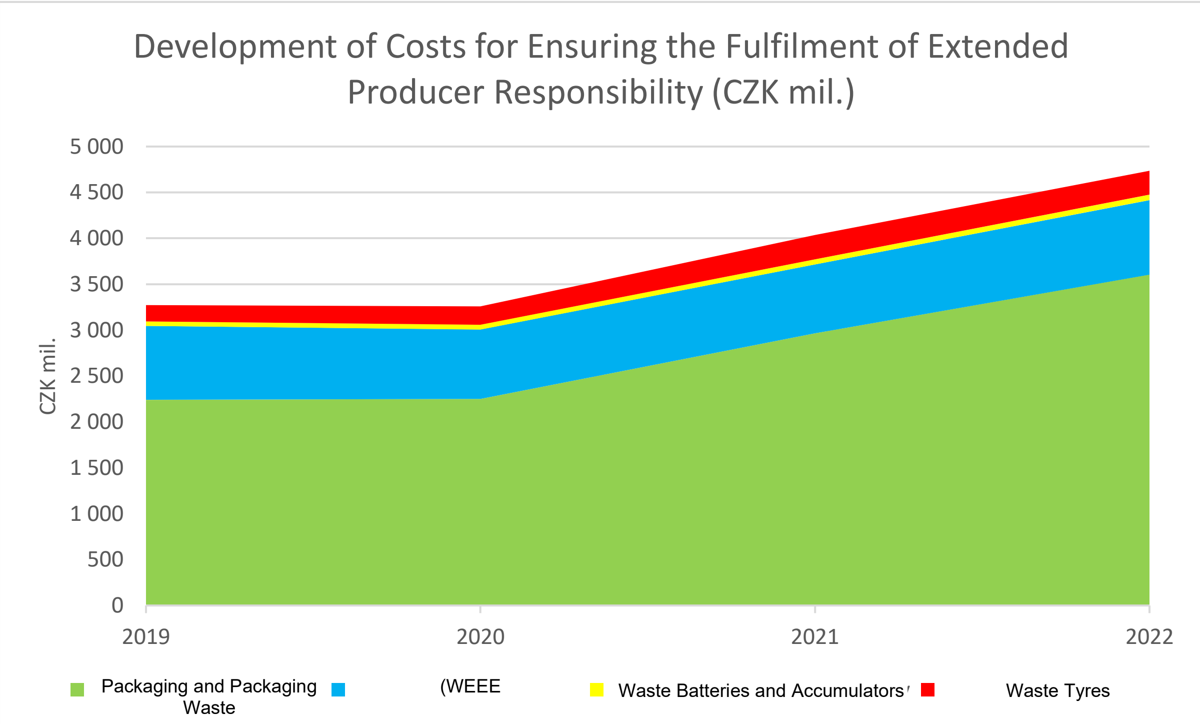
The collection and transport of mixed municipal waste account for roughly two-thirds of the total costs of municipal mixed waste management. The collection and transport of separately collected plastic waste then account for roughly three-quarters of the total costs of collection and transport of municipal plastic waste.

	The costs of municipalities associated with the collection and transport of commodities whose price is positive when transferred to a treatment facility (e.g. glass and paper) represent almost 100 % of the municipal costs for the given commodity.

2.6 Costs of Ensuring the Fulfilment of Extended Producer Responsibility

Within the available data, it may be stated that the total costs associated with ensuring extended producer responsibility increased over the period 2019 to 2022 by 45 %. The largest share of these costs is represented by the costs of ensuring extended producer responsibility within packaging and packaging waste. Their share gradually increased from 69 % to 76 % of all costs of extended producer responsibility systems in 2022. From the perspective of costs, the second most significant item is the systems ensuring the fulfilment of extended producer responsibility obligations for waste electrical and electronic equipment. The development of costs associated with ensuring obligations for the individual product groups is presented in the following graph (Graph 12). The graph further shows that costs across all collective schemes (and the authorised packaging company) began to increase more significantly only after 2020.

Graph 12: Development of Costs for Ensuring the Fulfilment of Extended Producer Responsibility (CZK mil.)



	The total costs of ensuring extended producer responsibility increased over the period 2019 to 2022 by 45 %. The largest share of these costs is represented by the costs of ensuring extended producer responsibility within packaging and packaging waste (76 %).

For the evaluation of costs associated with ensuring the fulfilment of take-back obligations in the Czech Republic, the annual reports and financial statements of the individual collective systems entered in the Commercial Register were used. In cases where such data were not available, they are not included in the following summary. From these statements, the data used were those under the item “Revenue from sales of products and services.” These primarily represent the fees of the clients of the given collective system for ensuring the service of extended producer responsibility. For this reason, such revenue can be regarded as costs associated with ensuring this service for the given commodity. This procedure is applied to all commodities subject to extended producer responsibility obligations. The costs for the individual product groups and the systems ensuring the collective fulfilment of obligations for these product groups are presented in the following tables.

2.6.1.1 Packaging and Packaging Waste

The following table (Table 19) shows that the revenue from sales of products and services of the authorised packaging company for performing the activity of extended producer responsibility increased between 2019 and 2022. Between 2019 and 2022, they increased by 37.8 %.

Table 19: Revenue from Sales of Products and Services of the Collective System of Extended Producer Responsibility – Packaging and Packaging Waste (CZK mil.)

System	Year			
	2019	2020	2021	2022
EKO-KOM, a.s.	2,241.22	2,250.82	2,965.55	3,605.67

Source: Trade Register

The total costs of clients for ensuring their obligations through the authorised packaging company (take-back and recovery of packaging waste) show a clear growth trend; in 2022, the costs of ensuring these obligations amounted to CZK 3.6 billion.

2.6.1.2 Waste Electrical and Electronic Equipment (WEEE)

The following table (Table 20) shows the development of revenue from sales of products and services of collective systems for waste electrical and electronic equipment in the Czech Republic between 2019 and 2022. It is evident that in the case of certain collective systems, revenue increased during the monitored period (REMA Systém, s.r.o., RETELA, s.r.o.), whereas in some collective systems revenue decreased (ASEKOL, a.s.). Nevertheless, in total, the revenue of collective systems declined after 2019. In 2022, however, growth above the 2019 level was recorded.

Table 20: Revenue from Sales of Products and Services of the Collective Systems of Extended Producer Responsibility – Waste Electrical and Electronic Equipment (CZK mil.)

System	Year			
	2019	2020	2021	2022
ASEKOL, a.s.	394.35	297.44	271.91	271.91
ASEKOL Solar s.r.o.	9.83	5.62	4.13	4.85
ČEZ Recyklace, s.r.o.	1.60	1.59	1.62	4.95
ECOPARTNER s.r.o.	data not detected	data not detected	data not detected	data not detected
EKOLAMP s.r.o.	36.79	31.22	38.35	36.80
ELEKTROWIN a.s.	258.50	265.06	229.37	250.21
FitCraft Recyklace s.r.o.	0.25	0.24	data not detected	data not detected
MINTES Solutions s.r.o.	data not detected	data not detected	data not detected	data not detected
PV Recovery, s.r.o.	0.28	0.19	0.40	0.23
Recycling Systems, s.r.o.	data not detected	data not detected	data not detected	data not detected
REMA System, s.r.o.	97.12	141.69	188.35	209.56
RESolar s.r.o.	0.35	0.55	0.63	0.07
RETELA, s.r.o.	6.80	11.37	15.14	31.45
Total	**805.88**	**754.97**	**749.90**	**810.02**

Source: Trade Register

The costs of clients for ensuring their obligations through collective systems of waste electrical and electronic equipment increased by 0.5 % between 2019 and 2022, and in 2022 amounted to CZK 810 million.

2.6.1.3 Waste Batteries

The following table (Table 21) shows the development of revenue from sales of products and services of collective systems of waste batteries between 2019 and 2022. In both collective systems, growth in revenue was recorded between 2019 and 2022, in total specifically by 23.3 %.

Table 21: Revenue from Sales of Products and Services of the Collective Systems of Extended Producer Responsibility – Waste Batteries (CZK mil.)

System	Year			
	2019	2020	2021	2022
ECOBAT s.r.o.	39	46	48	51
REMA Bartery, s.r.o.	7	7	8	8
Total	**46**	**53**	**56**	**60**

Source: Trade Register

The costs of clients for ensuring their obligations through collective systems of waste batteries amounted to around CZK 60 million in 2022. The trend of costs associated with ensuring take-back and recovery is increasing, with year-on-year growth exceeding 6 % in the last recorded period.

2.6.1.4 Waste Tyres

The following table (Table 22) shows the development of revenue from sales of products and services of the collective system of waste tyres, ELT Management Company Czech Republic, s.r.o., between 2019 and 2022. Even in this collective system, a relatively high growth is evident during the monitored period. Between 2019 and 2022, the revenue of this collective system increased by 31.8 %.

Table 22: Revenue from Sales of Products and Services of the Collective System of Extended Producer Responsibility – Tyres (CZK mil.)

System	Year			
	2019	2020	2021	2022
ELT Management Company Czech Republic s.r.o.	178.05	200.61	265.72	260.91

Source: Trade Register

The costs of clients for ensuring their obligations through the collective system of waste tyres amounted to CZK 261 million in 2022. The trend of costs associated with ensuring take-back and recovery is increasing in connection with the growth of the rate of ensuring collection and recovery.

2.6.1.5 End-of-Life Vehicles

In the case of the previous collective systems, the costs of extended producer responsibility were derived from the costs of clients for ensuring their obligations through collective systems of extended producer responsibility. This procedure cannot be applied to end-of-life vehicles because no collective systems exist in this area, only individual facilities for the management of end-of-life vehicles. Given the high number of such facilities, it was not possible to determine the costs of these facilities.

2.7 Costs of Other Waste Holders

In the Czech Republic, there is no comprehensive system for collecting data on the costs of waste management outside the collection of data on municipal costs. For this reason, it is not possible to adequately assess the costs associated with waste management in other segments, such as industry, construction and in other sectors, to the same extent as at the municipal level. Manufacturing companies have individual contracts with waste management companies and these data are not publicly available.

Despite this fact, an assessment of the anticipated average costs was carried out, based on consultations with final facilities receiving waste from waste holders or with waste management companies ensuring the collection and transport of waste.

Within the framework of other waste holders, groups of waste that are significant in terms of their quantity or hazardousness are assessed.

For each waste group, the price range associated with common methods of management is presented, while transport costs are disregarded within these waste streams.

2.7.1.1 Construction and Demolition Waste

The generation of this waste accounts for 24 % of the annual generation of all waste in the Czech Republic. The generation of construction and demolition waste varies over time and regionally and is linked to the intensity of construction activities (construction and renovation of houses, implementation of infrastructure projects, etc.).

Construction and demolition waste is predominantly recovered and recycled. The second most widespread method of managing construction and demolition waste is landfilling.

In the following table, the anticipated price range at the entry to facilities, the so-called gate-fee, is presented, which was determined on the basis of consultations with final facilities or waste management companies ensuring the collection and transport of waste. The level of costs is presented for the year 2023.

Table*23: Price Ranges for the Treatment of Construction and Demolition Waste at the Entry to Facilities, the So-called Gate-Fee in 2023 (CZK/t)*

Technology	From (CZK/t)*	To (CZK/t)*
recycling of construction and demolition waste**	200	1,100
recycling technologies (metal recycling)	-20,000	-500
landfills (for waste of the “other” category) – bricks, concrete, etc.	100	500
landfills (for waste of the “other” category) – asbestos, mixtures	1,000	1,500
landfills (for hazardous waste)	4,000	10,000

*In the case of a negative sign, this represents a positive price, i.e. a situation where the facility pays the waste supplier for receiving the waste.

** Depends on the purity of the waste and its composition.

2.7.1.2 Industrial waste

The share of hazardous industrial waste is around 20 % of the total generation of industrial waste. Some groups of the Waste Catalogue consist mainly of hazardous waste (groups 05, 06, 08, 09, 11, 13, and 14). Industry is the dominant source of hazardous waste.

In the last assessed year 2022, material recovery, mostly recycling, dominated in the management of industrial waste, and only a small part was landfilled. The management of industrial waste differs according to waste category, with higher recycling rates being achieved for non-hazardous waste.

The technologies used for the management of industrial waste are presented in the following table, including the range of costs paid at the entry to facilities. This anticipated price range at the entry to facilities, the so-called gate-fee, was determined on the basis of consultations with final facilities or waste management companies ensuring the collection and transport of waste. The level of costs is presented for the year 2023.

Table*24*: *Price Ranges for the Treatment of Industrial Waste at the Entry to Facilities, the So-called Gate-Fee in 2023 (CZK/t)*

Technology	From (CZK/t)*	To (CZK/t)*
landfills (for waste of the “other” category)	1,000	2,200
landfills (for hazardous waste)	4,000	10,000
facilities for energy recovery of waste (FERW)	1,400	2,200
composting plants	300	800
biogas plants	1,000	-3,600
recycling technologies (paper recycling)	-2,500	-1,000
recycling technologies (plastic recycling)	0	-15,000
recycling technologies (glass recycling)	-1,500	-500
recycling technologies (metal recycling)	-20,000	-500
incineration plants for hazardous waste	8,000	25,000
neutralization, de-emulsification	1,600	3,800
biodegradation	1,300	4,000
stabilisation	2,000	4,500

Source: field survey, personal consultations

*In the case of a negative sign, this represents a positive price, i.e. a situation where the facility pays the waste supplier for receiving the waste.

**This group also includes technologies commonly referred to under the abbreviations MBÚ (Mechanical-Biological Treatment), MBRT (Material Recovery and Biological Treatment).

2.7.1.3 Hazardous Waste

Hazardous waste, due to its nature and potential harmfulness to people, organisms, and the environment, represents a stream that requires adequate treatment capacities and the minimisation of risks associated with the transport and storage of hazardous waste.

The generation of hazardous waste is influenced mainly by industrial sectors, but also by the remediation of old environmental burdens and construction waste.

In the total generation of hazardous waste, several groups of catalogue numbers dominate. The most significant are waste from the group of construction waste (27.6 %), end-of-life vehicles, and waste from the dismantling of such vehicles (16.9 %), or waste from waste treatment (13.4 %).

The technologies used for the management of hazardous waste are presented in the following table, including the range of costs paid at the gate of the technology. This anticipated price range at the entry to facilities, the so-called gate-fee, was determined on the basis of consultations with final facilities or waste management companies ensuring the collection and transport of waste. The level of costs is presented for the year 2023.

Table*25*: *Price Ranges for the Treatment of Hazardous Waste at the Entry to Facilities, the So-called Gate-Fee in 2023 (CZK/t)*

Technology	From (CZK/t)	To (CZK/t)
landfills (for hazardous waste)	4,000	10,000
facilities for energy recovery of waste (FERW)	1,400	2,200
incineration plants for hazardous waste	8,000	25,000
neutralization, de-emulsification	1,600	3,800
biodegradation	1,300	4,000
stabilisation	2,000	4,500
production of alternative fuels	1,500	3,000

Source: field survey, personal consultations

2.7.2 Municipal Revenues

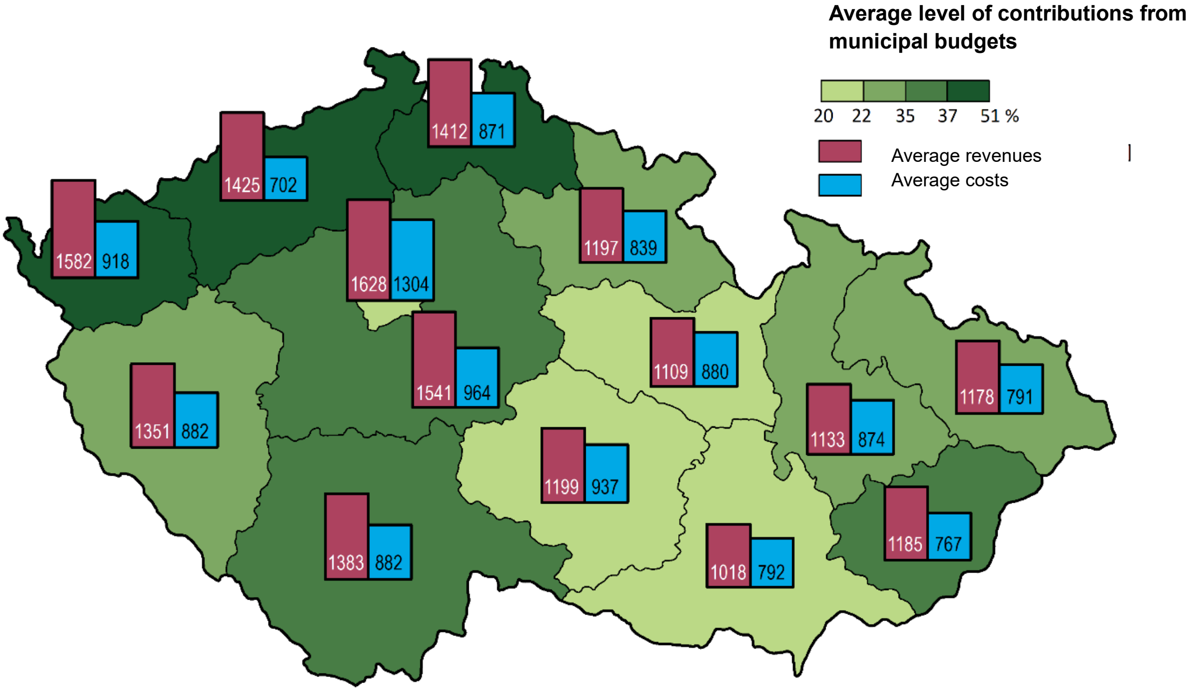
In addition to costs, municipalities also have revenue in the area of waste management. The largest source of revenue is the municipal waste fee, which municipalities may set in various ways. Other revenue may include fees from holidaymakers or owners of recreational properties in the municipality, as well as fees from tradesmen involved in the municipal system. Some municipalities also obtain revenue from the collection of textiles, from the sale of secondary raw materials, receive contributions from the authorised packaging company and other collective systems (e.g. for the collection of waste electrical and electronic equipment), accept payments from other municipalities for the use of collection yards, or receive compensation payments for the location of a landfill within their cadastral territory.

A significant revenue item is the remuneration from the authorised packaging company (AOS) for providing take-back points and for ensuring the collection and recovery of packaging waste.

In total, municipalities in the Czech Republic received in 2022 an average of CZK 911 per capita, of which revenue from fees from inhabitants amounted to CZK 606 per capita and revenue from AOS EKO-KOM amounted to CZK 181 per capita.

In the following map (Figuer9) the average data of total revenue per region are presented in comparison with the total costs and the share that municipalities in the given region on average have to cover from their budgets.

Figuer9: Map of the Average Level of Costs and Revenue in Municipal Waste Management and the Average Level of Contributions from Municipal Budgets by Region, Data for 2022



Source: Authorised Packaging Company

From the map above (Figuer9) it is evident that the average level of contributions from municipal budgets is highest in the Karlovy Vary, Ústí nad Labem, and Liberec regions, where it ranges between 37 % and 51 %. The lowest average level of contributions from municipal budgets in 2022 was in the Capital City of Prague, the Pardubice, South Moravian, and Vysočina regions, where it ranged between 20 % and 22 %.

In the following table (Table 26) a comprehensive overview of revenue items for 2022 is presented according to the size groups of municipalities. Similar to the costs, it should be emphasised that the total revenue is not a simple sum of the individual items and that the individual items are determined only for a valid sample of municipalities, i.e. only for those municipalities to which the given item applies.

From the table it follows that the highest payments from inhabitants in 2022 were recorded in municipalities with more than 1 million inhabitants, i.e. the Capital City of Prague (CZK 1,115.9 per capita), municipalities with 4,000 to 10,000 inhabitants (CZK 637.0 per capita), municipalities with 10,000 to 20,000 inhabitants (CZK 619.6 per capita), and municipalities with 1,000 to 4,000 inhabitants (CZK 616.2 per capita). With the exception of the above-mentioned municipalities, it can be stated that the level of payments from inhabitants decreased with the size of the municipality, at least in 2022. This also applies to revenue from other waste holders, profit from the sale of secondary raw materials, and revenue from the authorised packaging company. In total, the best position in terms of revenue was held by municipalities with more than 1 million inhabitants (CZK 1,306.6 per capita) and municipalities with 4,000 to 10,000 inhabitants (CZK 904.8 per capita). The worst position in 2022 was that of municipalities with 50,000 to 100,000 inhabitants (CZK 757.7 per capita) and those with 100,000 to 1 million inhabitants (CZK 773.9 per capita).

Table 26: Comprehensive Overview of Revenue by Size Groups of Municipalities in CZK per Capita for 2022

Size group	Unit Revenue [CZK per capita]				
	Payments from Inhabitants	Other Waste Holders[1]	Profit from Secondary Raw Materials[1]	Revenue from AOS	Total[2]
up to 500 inhab.	603.3	70.5	42.0	231.7	894.0
501-1 thous. inhab.	607.7	56.3	30.6	223.8	893.6
1- 4 thous. inhab.	616.2	53.8	29.6	177.9	862.3
4 - 10 thous. inhab.	637.0	57.1	21.7	189.8	904.8
10 - 20 thous. inhab.	619.6	54.0	18.2	168.2	848.4
20 - 50 thous. inhab.	589.5	10.7	35.3	151.4	841.1
50 - 100 thous. inhab.	590.7	5.8	13.6	163.4	757.7
100 thous. - 1 mil.	562.3	x	16.6	159.7	773.9
over 1 million inhab.	1,115.9	x	10.4	177.2	1,306.6
Total CR	**605.5**	**47.6**	**21.5**	**180.8**	**911.4**

[1] items are determined only for a valid sample of municipalities

[2] is not a simple sum of the items

Source: processed on the basis of data of the Authorised Packaging Company

The total amount of revenue is in most cases lower than the amount of costs, and municipalities therefore cover the deficit in waste management from their budgets. On average, municipalities thus had to find 31 % of the financial resources intended for ensuring the operation of waste management from other sources in their budgets in 2022. In 2023, this share increased to 34 %.

2.7.3 Prices and Costs of Waste Treatment in Selected Facilities

For the purposes of evaluating the Waste Management Plan, prices at the entry to facilities (the so-called gate-fee) ensuring the management of selected waste streams were also processed. There is no unified and transparent statistic of these prices. The data were collected through field surveys and consultations with representatives of individual facilities.

According to the requirements of the Waste Management Plan, the facilities concerned were as follows:

- landfills (for waste of the “other” category and for hazardous waste),
- facilities for energy recovery of waste (FERW),
- cement plants,
- sorting lines (for paper, plastics, glass, beverage cartons),
- composting plants,
- biogas plants,
- recycling technologies (recycling of paper, plastics, glass, metals),

- incineration plants for hazardous waste.

The determination of average prices is very difficult, as the price at the entry to facilities, i.e. the gate-fee, is influenced by a wide range of factors such as energy prices, labour costs, investments, the quantity, and quality of waste processed, and, in the case of waste treatment technologies, also the prices of secondary raw materials and other variables. In the table below (Table 27) price ranges representing the situation in 2023 are therefore presented.

Table 27: Price Ranges of Costs for Waste Treatment at the Entry to Facilities, the So-Called Gate-Fee in 2023 (CZK/t)

Technology	From (CZK/t)*	To (CZK/t)*
landfills (for waste of the “Other” category)	1,000	2,200
landfills (for hazardous waste category)	4,000	10,000
facilities for energy recovery of waste (FERW)	1,400	2,200
secondary sorting lines (for paper)	- 500	200
secondary sorting lines (for plastics and beverage cartons)	2,000	4,000
secondary sorting lines (for glass)	-1,200	-600
recycling of construction and demolition waste	200	1100
cement plants	-1,000	400
composting plants	300	800
biogas plants	-3,600	1000
recycling technologies (paper recycling)	-2,500	-1,000
recycling technologies (plastic recycling)	-15,000	0
recycling technologies (glass recycling)	-1,500	-500
recycling technologies (metal recycling)	-20,000	-500
incineration plants for hazardous waste	8,000	25,000
mechanical sorting of mixed municipal waste	1,200	2,000
neutralization, de-emulsification	1,600	3,800
biodegradation	1,300	4,000
stabilisation	2,000	4,500
Production of Solid Recovered Fuel (SRF)	1,500	3,000

Source: field survey, personal consultations

*In the case of a negative sign, this represents a positive price, i.e. a situation where the facility pays the waste supplier for receiving the waste. Within these intervals, the contributions from the authorised packaging company (AOS) for packaging waste processed by the facilities concerned are already taken into account.

From the table (Table 27) above, it follows that the highest prices for waste treatment are in hazardous waste incineration plants (up to CZK 25,000 per tonne) and hazardous waste landfills (up to CZK 10,000 per tonne). By contrast, in the case of recycling technologies it may often be a positive price, i.e. a situation where the facility pays the waste supplier for receiving the waste.

!	**The highest prices at the entry to facilities are reached by technologies managing hazardous waste, i.e. hazardous waste incineration plants (up to CZK 25,000/t) and hazardous waste landfills (up to CZK 10,000/t). The opposite extreme is represented by metal recycling facilities, where facilities pay up to CZK 20,000 for the acceptance of waste.**

2.8 Definition of Scenarios for the Development of Waste Management

In the preparation of the Waste Management Plan of the Czech Republic (WMP CR) for the period 2025–2035, a number of documents were prepared presenting outlooks for the generation and management of individual waste streams. The outlooks for the generation of individual streams and sub-streams used for building the economic framework were addressed in the relevant analytical documents of waste streams and are an important basis for the creation of scenarios for the development of waste management in the Czech Republic in the future. A summary of essential information is also presented in the WMP CR in the chapter Economic Analysis. Selected information contained in the WMP CR in Chap. 2.13 is also used here.

The basic supporting tool for building the future outlook of waste generation and management is Tiramiso, the web application of the Ministry of the Environment (MoE)[3]. Tiramiso makes it possible to estimate future generation for all types of waste and selected streams for the territory of the Czech Republic, regions, and municipalities with extended competence (MEC). The tool implements the requirements of the methodology[4] and is freely accessible on the web site of the Ministry of the Environment. The tool distinguishes between forecast and projections (scenarios).

Forecast

The forecast, in the sense of the methodology used for the development of the Tiramiso application, represents the most probable scenario of future development. It is based on historical data and does not include (except for necessary exceptions) an expert aspect, i.e. a change of trend due to expected interventions in waste management. The forecast does not have the capacity to respond to legislative and other interventions in the system that will occur in the future. Within the framework of scenario building, the forecast is referred to as the business-as-usual (BAU) scenario.

The key element for preparing the forecast is historical data on generation. It is therefore an approach that follows the long-term development in the generation of a specific catalogue number, subgroup, group, or stream. The Tiramiso tool also provides confidence bands of the forecast, i.e. a confidence interval. Since the development of most groups has been turbulent in recent years, with frequent significant changes and one-off leaps in generation, the confidence bands are very wide. The forecast can therefore be interpreted as the median (most probable) value with respect to current information and historical data.

Projection / Scenario

[3] Available from https://tiramiso.mzp.cz/

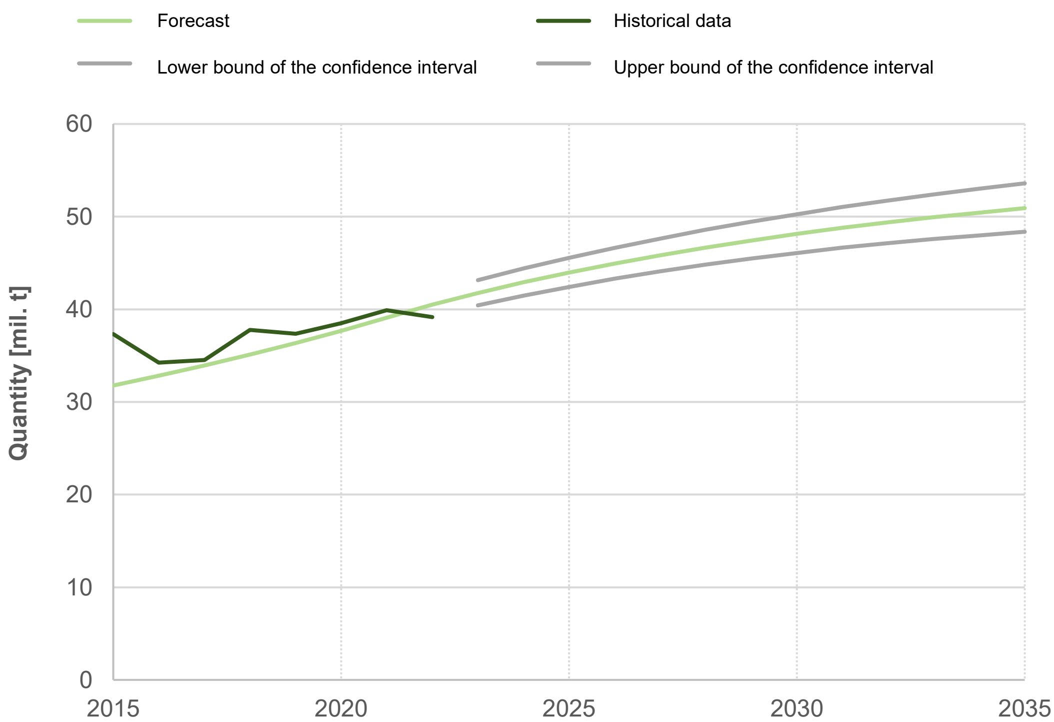
[4] Šomplák, R., Smejkalová, V., Bouda, Z., Szásziová, L., Suzová, J., Popela, P., Rosecký, M., Kůdela, J., Eryganov, I., Šramková, K., Pavlas, M. Certified methodology for conducting long-term forecasts of waste generation in the CR including revision of the forecast. Technical Report. Result V9, TIRSMZP719, 2021. Technical Report. Result V9, TIRSMZP719, 2021.

The projection is based on a defined scenario of future development. The projection takes into account expert-defined boundary conditions, but in such a way as to reflect the historical course as much as possible. The projection should be as consistent as possible with the forecast of future development. The projection can therefore be understood as an expert assessment of future development by means of scenarios that reflect situations where the system is influenced externally (legislative impacts, technological progress, etc.).

The forecast of the generation of all waste, together with the above-mentioned confidence interval, is shown in the following graph (Graph 13). According to the forecast, the total generation of waste will increase by 2035. From the current generation value of 39.2 million tonnes, an increase up to 51 million tonnes is expected. As a result of the integration of scenarios for municipal waste (Trajectories 1 and 2), see below, it may be slightly lower (50 million tonnes).

Development of Total Waste Generation	**Future development based on historical data expects that the generation of all waste in the CR may increase to more than 50 million tonnes by 2035.**

Graph 13: Forecast of Waste Generation by 2035



Source: Generation data 2022 – WMIS, forecast Tiramiso

The aspects influencing waste generation are mentioned for individual streams in the analytical documents. In summary, the following can be stated:

- Economic development, the condition of the economy and its segments, the level of construction activity and the industrial sectoral structure.
- Demographic development and consumer preferences.

- The level of waste prevention at the level of municipal waste (age structure of the population, education of the population, environmental awareness of the population) and industrial waste including hazardous waste (preferences for sustainable production, circular audits).
- Improved waste reporting, inspection activities, and compliance with legislation also lead to a long-term increase in generation.

The projection (scenario) was used mainly for municipal waste, where a significant change in the generation of certain sub-streams is expected as a necessary precondition for achieving the objectives of municipal waste management. For the preparation of the projection, long-term analytical work, data collection, and processing were used at the level of the Ministry of the Environment, expert advisers, and the academic sphere (e.g. in project TIRSMZP719 and CEVOOH). For most of the other streams, the forecast was used, as the necessary expert background was not available and the preparation of scenarios was therefore not carried out, or the forecast sufficiently described the expected future development.

2.8.1 Scenarios of Generation and Management of Municipal Waste

2.8.1.1 Municipal waste generation

Based on the consideration of the above-mentioned aspects, two scenarios of municipal waste generation, i.e. individual sub-streams, have been developed. The scenarios are designated as the **optimistic** and the **realistic scenario.** The scenarios assume a percentage of citizens participating in sorting. According to available data, 75% of citizens currently sort their waste.

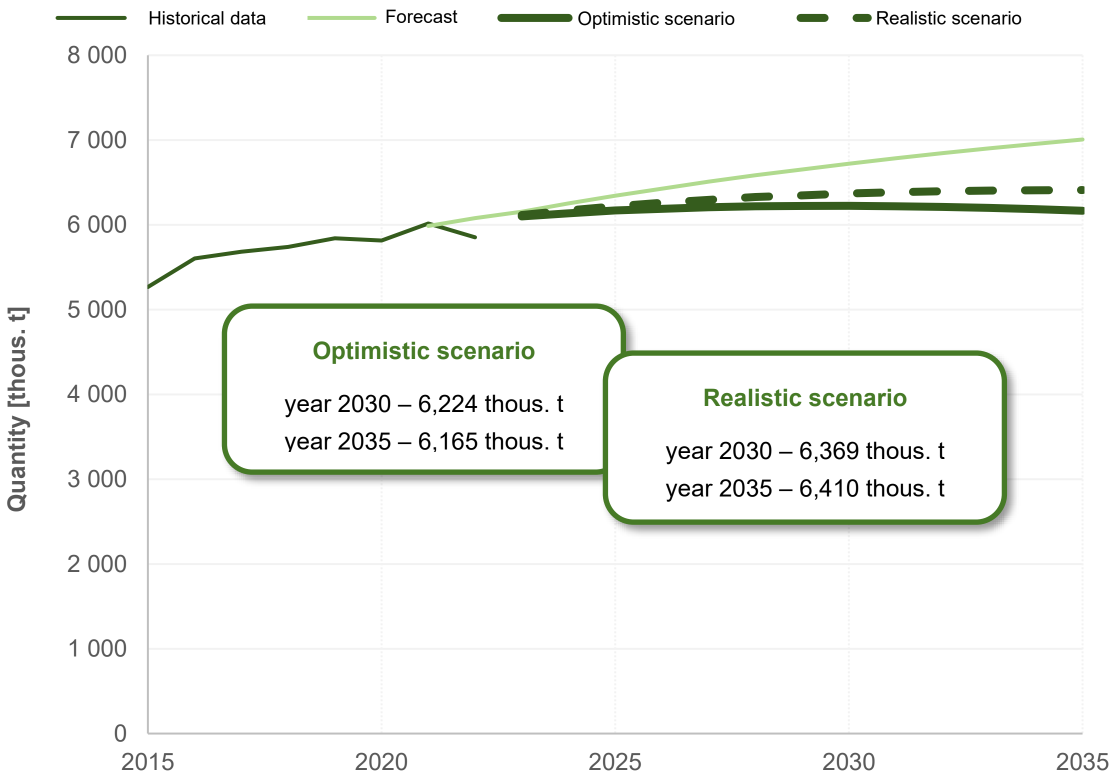
- **In the optimistic scenario of generation (Trajectory 1 – T1)**, prevention activities are highly effective, with **86% of citizens** intensively sorting municipal waste. The amount of sorted fractions increases, even though the occurrence of material-recoverable fractions in municipal waste decreases as a result of prevention. Prevention affects all sub-streams, but the degree of achieved prevention differs for various sub-streams. Specific measures are presented in the document Waste Prevention Programme. Sorting also concerns bulky waste directly by inhabitants or by the operation of collection yards, thereby leading to a decrease in the generation of bulky waste.
- **In the realistic scenario of generation (Trajectory 2 – T2)**, prevention activities are less effective. Municipal waste is intensively sorted by **81% of citizens**. The lower percentage of inhabitants willing to sort is also reflected in the generation of bulky waste (those who will not be willing to sort basic materials such as plastics, paper, glass, or biodegradable waste will also not be willing to sort bulky waste).

	Current Situation	**Optimistic scenario (Trajectory 1)**	**Realistic scenario (Trajectory 2)**
Sorting by Citizens	**75%**	**86%**	**81%**
	citizens sort today	**citizens will be intensively sorting in 2035**	**citizens will be intensively sorting in 2035**

The results of the scenarios for the entire municipal waste stream are shown in the following graph (*Graph 14*). In both trajectories, as a result of prevention measures, the growing generation of municipal waste is successfully stopped. In the case of the optimistic scenario (Trajectory 1), municipal waste generation in 2025 is expected to be approximately 6.2 million tonnes. For the realistic scenario (Trajectory 2), this amounts to 6.4 million tonnes of municipal waste.

The two trajectories further differ in the level of sorting of bulky waste and mixed municipal waste.

Graph 14: Scenarios of Municipal Waste Generation Development



Source: WMIS generation data 2022, Tiramiso forecast, own projections

Prevention	**Both the optimistic and realistic scenario take into account significant prevention of municipal waste generation. The long-term upward trend in municipal waste generation will be halted. However, the impact on the generation of all waste will be negligible.**

2.8.1.2 Scenarios of Municipal Waste Management

The scenarios of future municipal waste generation are followed by management scenarios. For both the optimistic and the realistic scenarios of municipal waste generation (Trajectories 1 and 2), **three management scenarios (N1, N2, and N3)** have been prepared, which means that in total there are 6 possible pathways of municipal waste management leading to the fulfilment of the recycling targets for municipal waste and the diversion of municipal waste from landfills. The binding targets for municipal waste are as follows:

- To increase the level of preparation for re-use and recycling of municipal waste to at least 55% in 2025, 60% in 2030 and 65% in 2035.
- To reduce by 2035 the amount of municipal waste landfilled to 10 % (by weight) or less of the total amount of municipal waste generated.

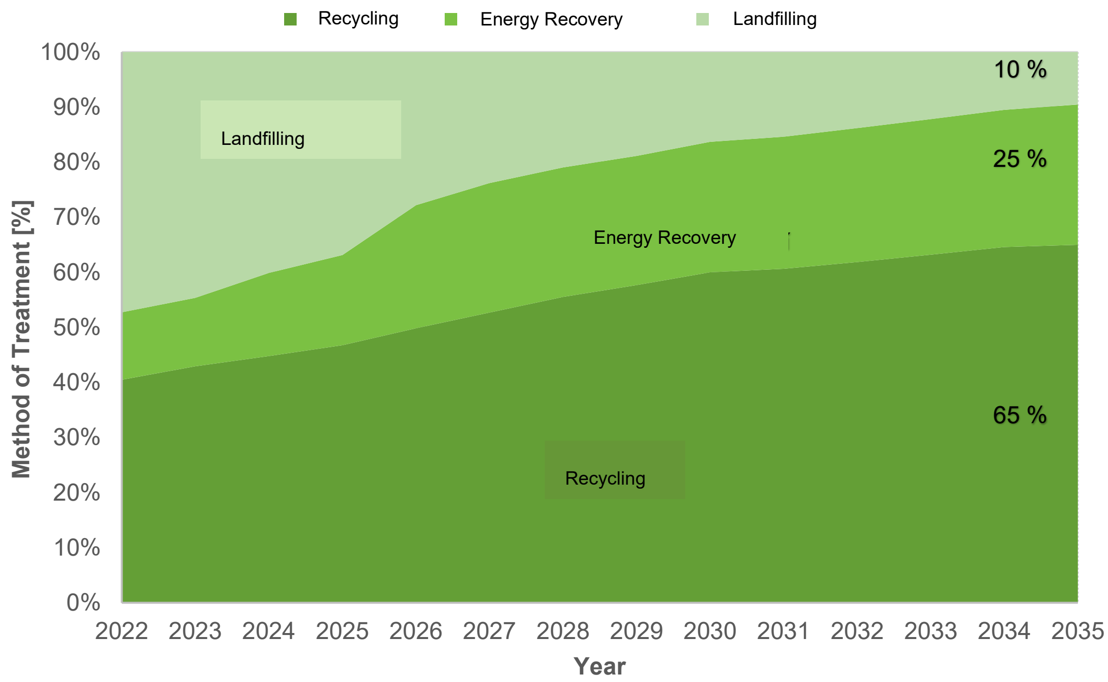
Targets for Reuse and Recycling	Level of preparation for re-use and recycling of municipal waste		
	55% in 2025	**60%** in 2030	**65%** in 2035
	Landfilled maximum **10%** 10% of generated municipal waste in 2035		

The scenarios differ in the **extent of municipal waste landfilling** in 2035, with the **maximum value being 10%** (scenario N1), in scenario N2 it is lower, and in scenario N3 the minimum realistic value is achieved (approaching zero). Corresponding to the decline in the landfilling rate, the **share of energy recovery increases** (theoretically from 25% to 35% with zero landfilling).

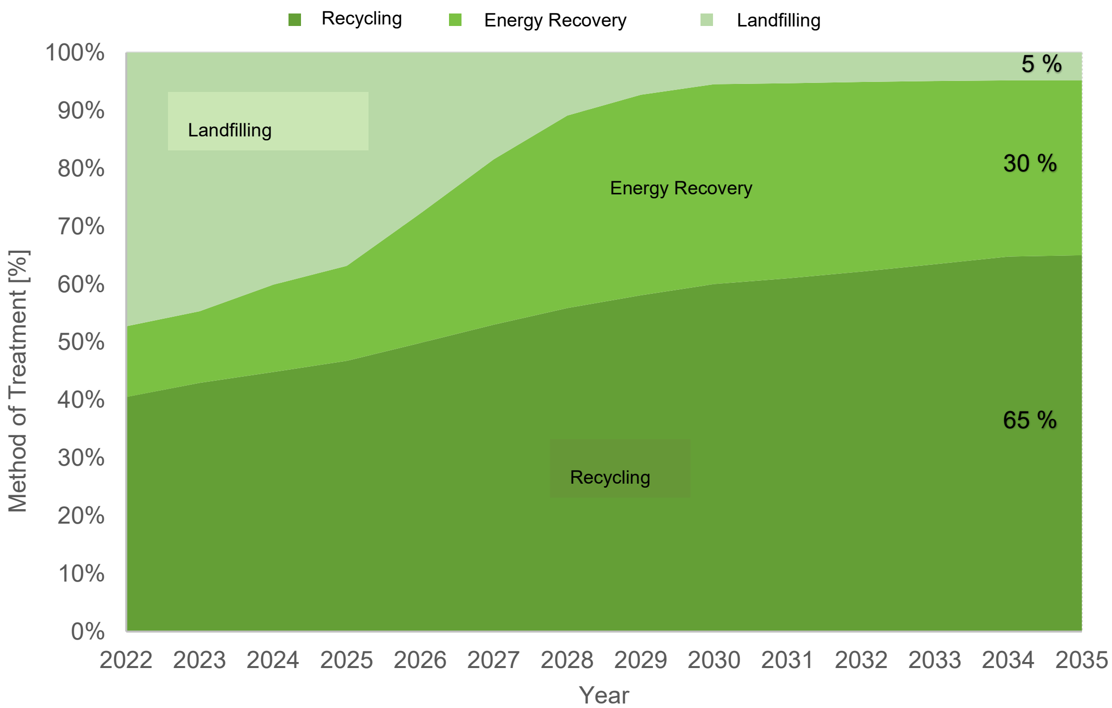
Scenarios of Municipal Waste Management	Proposed Management Scenarios for 2035					
	Scenario N1		**Scenario N2**		**Scenario N3**	
	Recycling	**65%**	**Recycling**	**65%**	**Recycling**	**65%**
	Energy Recovery	**25%**	**Energy Recovery**	**30%**	**Energy Recovery**	**35%**
	Landfilling	**10%**	**Landfilling**	**5%**	**Landfilling**	**0%**

The gradual development in waste management towards the established targets is illustrated in the following graphs (Graph 15 , Graph 16 and Graph 17). Since the progression expressed in percentages is essentially the same for both the optimistic and realistic scenarios, a single common graph is shown for both municipal waste generation scenarios, i.e. for the optimistic scenario (T1) and the realistic scenario (T2).

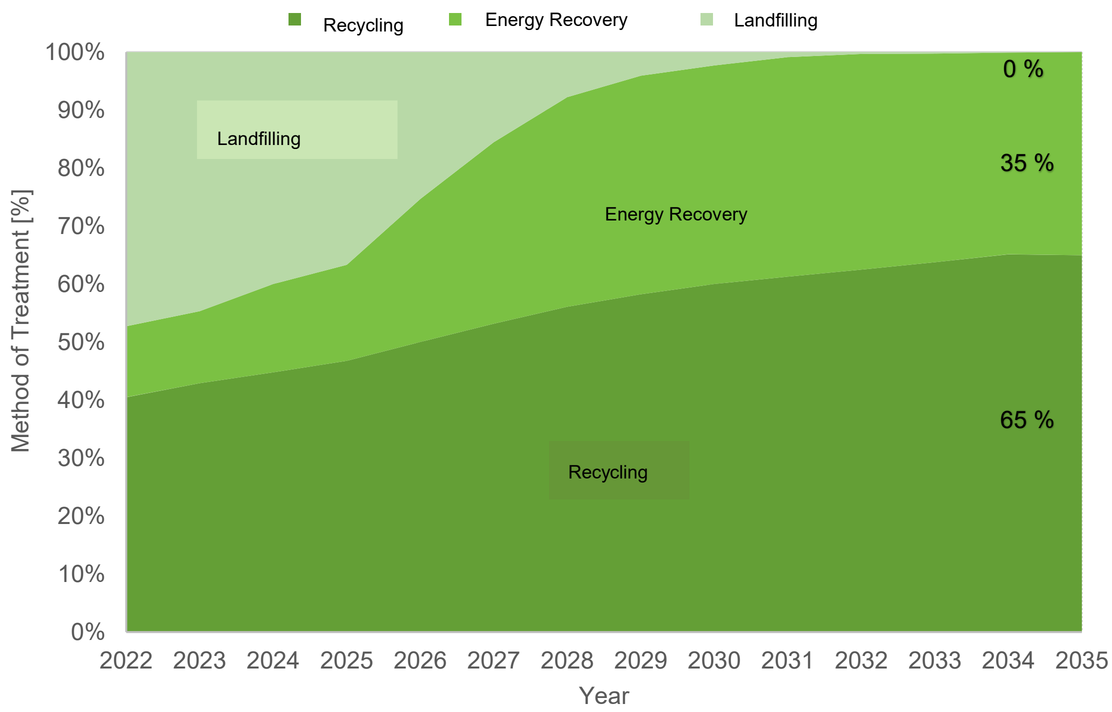
Graph 15: Modelling of Municipal Waste Management for Management Scenario N1 (chart common to both the optimistic and the realistic scenarios of municipal waste generation – Trajectories 1 and 2)



Graph 16: Modelling of Municipal Waste Management for Management Scenario N2 (chart common to both the optimistic and the realistic scenarios of municipal waste generation – Trajectories 1 and 2)



Graph 17: Modelling of Municipal Waste Management for Management Scenario N3 (chart common to both the optimistic and the realistic scenarios of municipal waste generation – Trajectories 1 and 2)



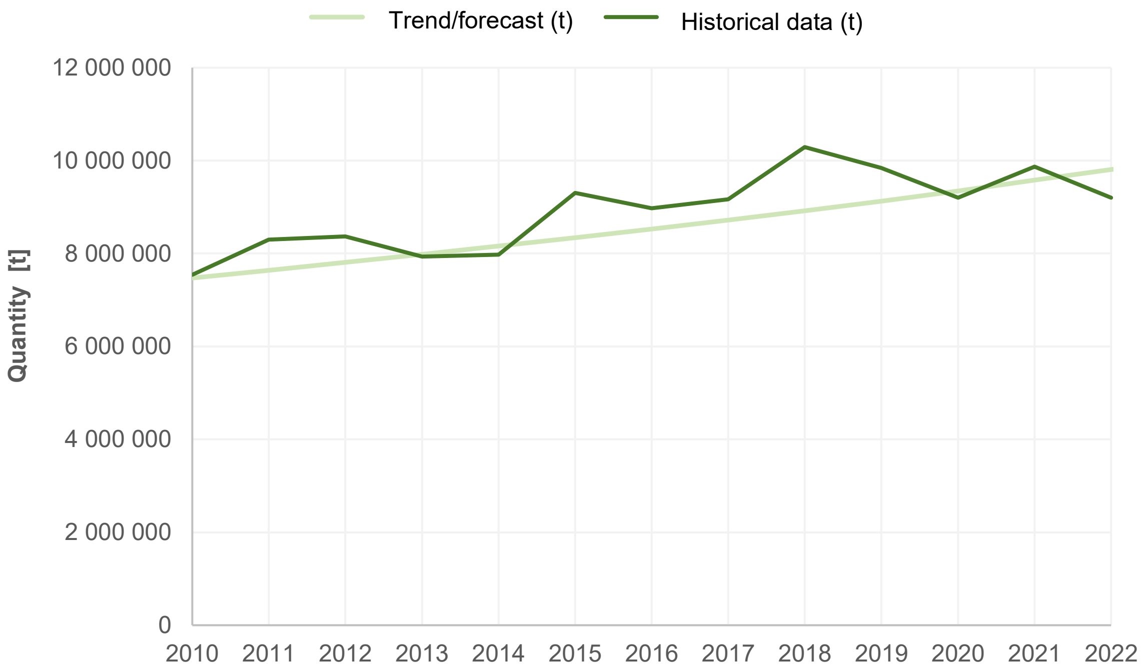
2.8.2 Expected Future Generation and Management of Selected Other Streams

2.8.2.1 Construction and Demolition Waste

Construction and Demolition Waste (C&DW) is, pursuant to Act No. 541/2020 Sb. on Waste, understood as waste generated during construction and demolition activities. Construction and demolition waste represents a significant stream of generated waste in the Czech Republic. Construction and demolition waste includes catalogue numbers of Group 17 with the exception of several catalogue numbers of Subgroup 17 05 (Soil and stones, dredging spoil).

The generation of construction and demolition waste in the Czech Republic has shown a long-term increasing trend, which in recent years has rather shifted into a slight decline. The forecast expects a continuation of the increasing trend in the coming years and is in line with expectations that the economy of the Czech Republic will grow in the coming years, and, in connection with that, construction activity will also continue.

Graph 18: Generation of construction and demolition waste



Source: processed on the basis of WMIS

Construction and demolition waste is predominantly recovered and recycled. The second most widespread method of managing construction and demolition waste is landfilling. Construction waste is also landfilled, which under the new legislation will not be possible from 2030 onwards. In 2022, this amounted to 262 thousand tonnes, and this quantity has been approximately constant in the long term.

The current capacities of recycling lines for construction and demolition waste appear sufficient in view of current generation. In the context of achieving the recycling targets for construction and demolition waste in 2030 and especially 2035, when it will be necessary to increase the amount of recycled construction and demolition waste by approximately 600 thousand tonnes, it will be necessary to expand processing capacities. The analysis revealed a fundamental deficit in technologies for the recovery of metals from construction and demolition waste (Subgroup 17 04). For the whole of the CR, this deficit amounts to 600 thousand tonnes. Based on market experience, it is expected that 30 % of the required increase will be covered by current technologies. The remaining 400 thousand tonnes will require new recycling lines. A standard recycling line with a medium-sized crusher has an hourly processing capacity of 60 to 80 t/h of input material. With an assumed working time fund of 2,000 h/year, the annual treatment capacity is in the range of 100 to 125 thousand tonnes. A recycling line for construction and demolition waste may be permitted as a mobile facility (travelling to waste holders and their waste) or a stationary facility (waste is transported to the facility).

In the case of an increase in construction and demolition waste by approximately 2.4 million tonnes according to the forecast, of which up to 1.8 million tonnes is forecast for sub-group 17 01, it would be necessary to recycle an additional **2.7 million tonnes of construction and demolition waste** compared to the current situation. In such a case, most of the newly generated construction and demolition waste would have to be recycled, which requires adequate technologies as well as substantial investment resources. Taking into account the current deficit of treatment capacities of around 400 thousand tonnes, the need for new treatment capacities by 2035 will be at the level of 3 million tonnes.

2.8.2.2 Hazardous Waste

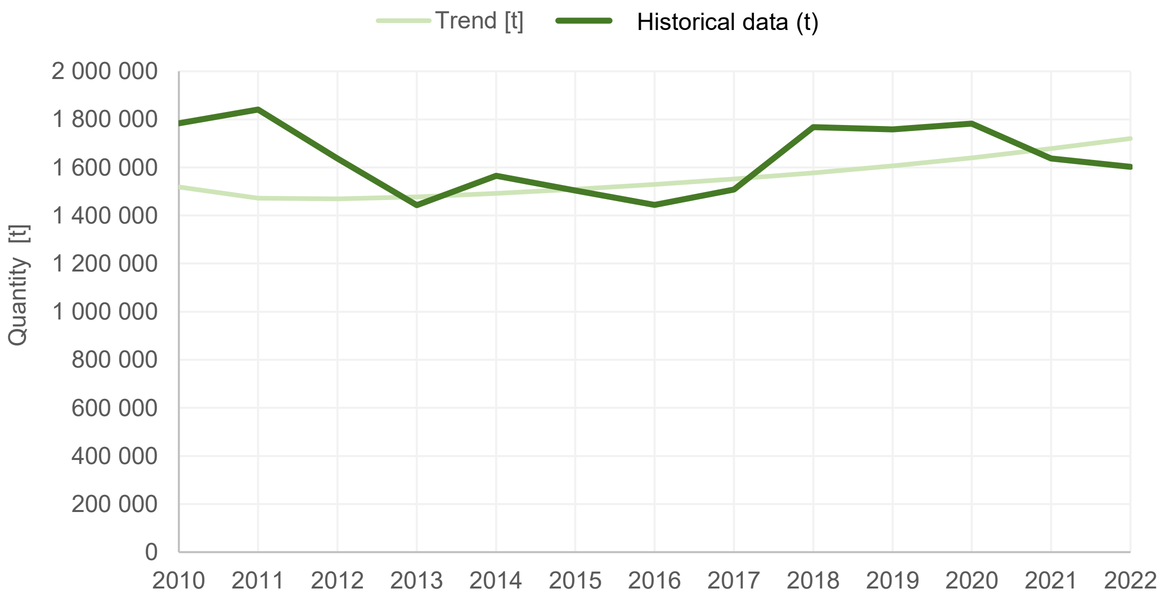
Hazardous waste, due to its nature and potential harmfulness to humans, organisms and the environment, represents a stream that requires adequate processing capacities.

The generation of hazardous waste is influenced predominantly by industrial sectors, but also by the remediation of historical environmental burdens. It is precisely the remediation of historical environmental burdens that has long caused year-on-year fluctuations in hazardous waste generation in individual regions. In some cases, the generation of hazardous waste may also be influenced by construction and demolition activities.

Generation of hazardous waste throughout the Czech Republic (Graph 19) showed a rather declining trend until 2016. However, between 2016 and 2018 an increasing trend in hazardous waste generation is evident, followed by stagnation between 2018 and 2020. The most recent data show a slight decrease in generation in 2022 compared to 2020.

Generation in 2022 amounted to 1,602 thousand tonnes, accounted for by 425 catalogue numbers. The majority of them were, in accordance with the Waste Catalogue, classified as hazardous waste. (N/A). Furthermore, in the case of 98 catalogue numbers defined as Other waste, a situation occurred where the waste displayed one of the hazardous properties and was subsequently recorded as hazardous waste (O/N). This concerned a total of 31,124 tonnes of waste. Conversely, in the case of 38 catalogue numbers defined as hazardous waste, a situation occurred where they did not display hazardous properties and were recorded as Other waste (309,947 t).

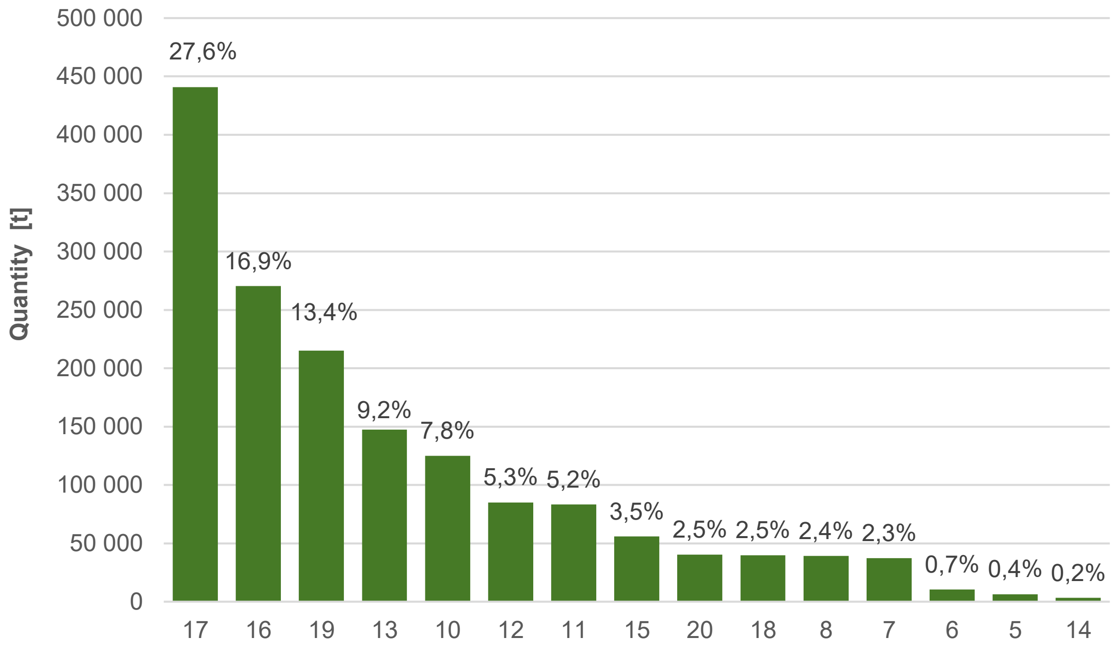
Graph 19: Generation of Hazardous Waste



Source: processed on the basis of WMIS and Tiramiso

In the total generation of hazardous waste, several groups of the Waste Catalogue dominate. The most significant are waste of group 17 (27.6 %), group 16 (16.9 %), or group 19 (13.4 %) (graph 20).

Graph 20: Groups of the Waste Catalogue Represented in Hazardous Waste in 2022 – Most Significant Subgroups



Source: processed on the basis of WMIS

Given the diversity of hazardous waste, it is appropriate to monitor its generation and the network of facilities for its management by subdividing into sub-streams according to their physic-chemical properties, which determine the type of facility required for their processing.

Waste identified as waste that should be treated at neutralisation stations is treated there. The capacity of de-emulsification plants is almost sufficient for current generation.

Waste identified as waste that should be treated at neutralisation stations is treated there. The capacity of neutralisation stations is sufficient for current generation. The network of neutralisation stations is uneven, as is the case with de-emulsification stations.

Wastes classified in the sub-stream of wastes exclusively for biodegradation or suitable for biodegradation are managed predominantly in the preferred manner. Key is the generation of waste suitable for biodegradation in view of the negligible generation of waste intended exclusively for biodegradation. Non-preferred management is the disposal of waste as technological material for landfill sealing, which causes a capacity deficit of up to 80 thousand tonnes. The capacity of biodegradation areas is not sufficiently distributed across the territory of the Czech Republic. Wastes classified in the sub-stream of wastes that should end exclusively at stabilisation lines are managed in 80% of cases in the preferred manner. In the future, non-preferred management will be dominated by the use of waste as technological material for landfill cover. The utilisation of stabilisation lines, in view of the current generation of hazardous waste, is insufficient and from a nationwide perspective there is a deficit of 25 to 30 thousand tonnes. When fulfilling the forecast, capacities should be strengthened.

Incinerators for hazardous waste are a key technology for the safe management of combustible hazardous waste. With current hazardous waste generation, there is a shortfall of incineration capacity of roughly 45 thousand tonnes. The quantity of this waste is still increasing.

3. Input Parameters of the Impact Analysis on Costs and Revenues in Waste Management

3.1 Waste Generation

1) **Economic Growth and Its Impact on Waste Generation**

An almost linear dependence of waste generation on economic growth is a characteristic feature of developing economies. Due to the effects of new environmental policies, waste generation should decouple from economic growth, which can be considered one of the hallmarks of advanced economies, moving from quantitative metrics to qualitative characteristics in the assessment of quality of life. Within the modelling, emphasis was placed on waste prevention through more efficient production, conscious consumption, educational activities of the MoE and other institutions, particularly from the public sector and the non-profit sector, and the significant expansion of preventive measures relating to waste generation into the everyday life of inhabitants and companies. **This behavioural change has an impact on long-term stagnation in a longer time horizon (2035 and beyond), with even a slight decrease in total waste generation.**

2) **Assumption of the Development of Individual Waste Streams**

Waste generation for individual waste streams was predicted in relation to the fulfilment of legislative targets. For each waste stream, the prevention potential within waste prevention was assessed and determined, as well as the potential for the development of separate collection and future management, with the aim of maximising preparation for recycling and reducing landfilling, linked to the possibilities of developing waste infrastructure and the participation of inhabitants in the collection system.

The assumed development of generation and management methods was prepared on the basis of outputs of a focus expert group into two variants of production scenarios: the Optimistic Scenario (Trajectory T1) and the Realistic Scenario (Trajectory T2), and three management scenarios (N1, N2 and N3). Altogether, this results in 6 possible pathways for the management of municipal waste (see Chap. 2.8). **Scenarios of generation and management of municipal waste are prepared at the level of municipalities as well as other waste holders of municipal waste.**

3.2 Economic Characteristics

1) **Costs of Unit Processes**

The costs associated with ensuring the required methods of waste management can only be predicted for waste streams with similar properties and similar behaviour of waste holders in managing them. A similar condition for estimating costs applies to waste streams for which relevant economic data on unit fixed and variable costs exist.

This definition is primarily met only by municipal waste. From knowledge of municipal cost data, it is also possible to make a qualified estimate of the expected unit costs of other waste holders when managing municipal waste.

For the above reason, detailed predictions of the development of costs associated with the management of municipal waste are prepared, both originating from municipalities and from other waste holders.

Costs Associated with the Management of Municipal Waste

So far, the only data collection on costs in municipal waste management has been carried out by the authorised packaging company. In the following years, this situation should change, and data for municipal waste should also be systematically collected by the state administration. From these data, further analyses can then be prepared, which will better describe the state of waste management in the Czech Republic and enable better modelling of future developments.

Data on municipal costs represent the costs invoiced to them by collection companies. These costs include all costs associated with the provision of the activity concerned (operating and investment costs).

Data on the costs of other waste holders than municipalities are not systematically collected. The data are determined by individual contractual conditions, which are not publicly available, and which show significant variability, making it difficult to approximate costs on the basis of a sample survey of part of the market.

Assumptions for Calculations for Municipal Waste

For the purpose of cost calculations, it was necessary to obtain data on unit costs associated with specific management provided to the end customer. The method of determining unit costs per tonne of treated waste was carried out in the manner set out in the following tables.

Table*28*: *Data Sources for the Calculation of Costs Associated with the Management of Individual Waste Streams of Municipal Waste Relating to Municipalities and Other Waste Holders*

Commodities	Data source for calculations
Paper	Average data of municipalities in the Czech Republic
Plastics	Average data of municipalities in the Czech Republic
Glass	Average data of municipalities in the Czech Republic
Metal	Average data of municipalities in the Czech Republic
Textiles	Qualified price determination
Biowaste of Plant Origin	Average data of municipalities in the Czech Republic
Kitchen Biowaste and Catering Waste	Qualified price determination
Edible Oils	Qualified price determination
Wood	Qualified price determination
Hazardous Waste	Qualified price determination
Waste from marketplaces	Qualified price determination + price calculation of the final facility
Sweepings	Qualified price determination + price calculation of the final facility
Bulky Waste	Average data of Czech municipalities + calculation of the final facility
Mixed Municipal Waste	Average data of Czech municipalities + calculation of the final facility
Other	Qualified price determination + price calculation of the final facility

Source: own processing, modelled on the basis of municipal data

2) Inflation and Its Impact on Price Growth

Several variants of the impact of inflation on prices in waste management were modelled. Within the modelling, the assumption was adopted that the development of inflation for individual activities and methods of waste management in waste management is identical to the development of the average inflation rate according to the prediction of the Ministry of Finance.

The expected development of average inflation was taken from the prediction of the Ministry of Finance within the 58th Colloquium – Survey of Forecasts of the Macroeconomic Development of the Czech Republic (2023–2025). For the following period, i.e. 2027 and beyond, a year-on-year inflation trend of 2 % is assumed, corresponding to the long-term inflation target set by the Czech National Bank. Within the modelling, it is also possible to simulate the development of waste management costs without inflation, i.e. recalculating costs in 2022 prices.

Table*29*: *Inflation in the Basic Setting (in %)*

	2021	2022	2023	2024	2025	2026- 2035
Average inflation rate (%)	3.8	15.1	10.7	2.5	2.3	2

Source: Until 2023 – historical development according to the CZSO, in the years 2024–2025 prediction of the Ministry of Finance within the framework of the 58th Colloquium, thereafter assumption of development.

3) Exchange Rate Differences CZK/EUR and the Impact on the Prices of New Technologies

Owing to the historical development of the exchange rate, including fluctuations during the covid-19 pandemic, its stable development and oscillation within the range of 24 to 25 CZK/EUR can be assumed. In the event that the Czech Republic were to enter the ERM II system, the CZK exchange rate against the euro would be rather stable. For the above reasons, an **exchange rate of 24.5 CZK/EUR is assumed** in the prices of technologies needed to equip the current waste management sector in order to achieve all the objectives of the WMP CR – macroeconomic prediction of exchange rate development belongs among the most difficult areas of prediction within macroeconomic analysis and goes beyond the scope of this study.

Table*30*: *Monthly Averages of the CZK/EUR Exchange Rate*

Year	Month												Annual average
	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	
2017	27.02	27.02	27.02	26.82	26.56	26.26	26.07	26.10	26.08	25.77	25.54	25.65	26.33
2018	25.45	25.32	25.43	25.36	25.64	25.78	25.84	25.68	25.61	25.82	25.93	25.83	25.64
2019	25.65	25.73	25.68	25.68	25.77	25.60	25.55	25.80	25.87	25.70	25.53	25.50	25.67
2020	25.22	25.05	26.58	27.26	27.27	26.68	26.51	26.17	26.72	27.20	26.46	26.31	26.45
2021	26.14	25.88	26.18	25.92	25.56	25.45	25.64	25.47	25.39	25.49	25.40	25.26	25.65
2022	24.47	24.44	25.01	24.44	24.75	24.72	24.58	24.57	24.57	24.53	24.37	24.27	24.56
2023	23.96	23.71	23.68	23.44	23.60	23.70	23.90	24.11	24.39	24.59	24.49	24.48	24.00
2024	24.72	25.23	25.29	25.28	24.80	24.78	25.30	25.18	25.01	25.29	25.30	25.14	25.11

Source: ČNB

4) VAT

The change in the VAT rate is significantly reflected in the final prices for waste holders. VAT has a fundamental impact on municipalities that are not VAT payers, and thus also on their citizens. In 2021, the VAT rate on municipal waste originating from municipalities was reduced from 21 % to 15 %. From 2024, VAT rates for municipal waste from municipalities were unified with those of other waste holders at 21 %. **In the modelling, a VAT rate of 21% was applied throughout the entire period; in view of the discussion held during the negotiations on the consolidation package, this rate may be regarded as a long-term stable upper VAT rate.**

5) Landfill Disposal Fees

Within the predefined scenarios of landfill charges, two variants of charges were used for the calculations, reflecting the current setting including the parameters for achieving the landfill discount. Another variant is the possibility of increasing/decreasing the current setting of landfill charges.

Within the modelling, parameters were defined for the deposited amount per capita, under which the municipality qualifies for the reduced landfill charge rate.

6) Emission Allowances for Energy Recovery of Waste in FERW

Within the analysis, account was also taken of the market price of emission allowances within the cost framework of energy recovery of waste. For the determination of the share of emission allowances in incineration costs, calculations of FERW regarding the presence of fossil carbon in the waste were taken into account.

3.3 Other Influences

1) Development of Extended Producer Responsibility Systems

Within the assumption of the development of waste management, further development of extended producer responsibility with regard to ensuring the fulfilment of collection and recycling targets or recovery through municipal systems is taken into account.

It is assumed that these extended producer responsibility (EPR) systems will contribute to covering the costs associated with ensuring the collection and transport of end-of-life products within municipal systems.

2) Political Cycle

The risk of changing priorities in relation to the economic instruments used to stimulate the fulfilment of the objectives of the WMP CR, such as taxes, charges, subsidies, methods of charging residents, etc., but also the setting of targets and their possible postponement, may vary significantly influence the trust and behaviour of residents in relation to waste management, including influencing the decisions of the waste sector in the area of investment in the necessary infrastructure. **Within the modelling, the assumption was used that future political decisions will not interfere with the set legislative targets and that environmental policies in the Czech Republic will be stabilised by the expert positions of the European Union and the responsible institutions in the Czech Republic, led by the expert apparatus of the MoE.**

3.4 Primary configuration of calculation parameters

Variable values were used in the analysis for the calculations of impacts on costs and revenues in waste management. An overview of these variables is presented below. The analysis is prepared on the basis of the stated variables. In the case of different variables or different input data, the analysis could provide different results.

1. **Scenarios of generation and management of municipal waste (T1N1 to T2N3) described in Chapter 2.8. In total, there are 6 scenarios.**
2. **Number of inhabitants according to the CZSO – medium variant.**
3. **Average costs of municipal waste – outputs of the Authorised Packaging Company – Economics of Waste Management in 2022. Another source of information on the costs of municipal waste is field surveys of technology operators and their customers.**
4. **Inflation – development of inflation processed by the Ministry of Finance within the framework of the 58th Colloquium – Survey of Forecasts of the Macroeconomic Development of the Czech Republic (2023–2026). For the following year, i.e. 2027 and beyond, a year-on-year inflation trend of 2 % is assumed and its reflection in the prices for waste management.**
5. **VAT – 21 %**
6. **Landfill charges – existing applicable legislation. Within the analysis, the impact of changes in the landfill charge for recoverable waste and residual waste for the municipal waste stream was also tested.**
7. **For the purpose of calculating municipal financing by EPR systems, the following extended producer responsibility systems were used:**
   - Packaging
   - Textiles
   - Furniture
   - Flyers
   - Other Products (for example, “home and garden”, “sport”).

Product groups represented by the above-mentioned types of extended producer responsibility (EPR) systems account for a significant part of municipal waste.

EPR systems for electrical equipment, batteries, tyres, and end-of-life vehicles are not included in the financial revenues of municipalities, as these systems predominantly ensure collection and transport independently.

4. Analysis of Economic Instruments

The analysis of the evaluation of waste management instruments in the Czech Republic shows that a number of legal, economic, administrative and information instruments have been adopted and used to support and achieve the objectives of waste management. The legal framework has been strengthened by new acts, such as the Waste Act, the End-of-Life Products Act, the Packaging Act, and the Act on the Reduction of the Impact of Certain Single-Use Plastic Products on the Environment, which introduced changes, for example, in the obligations of waste holders, the regulation of illegal dumpsites and waste charges. At the same time, strategic documents such as the State Environmental Policy and the Strategic Framework for the Circular Economy have been updated, aiming at long-term goals in the field of waste management.

Economic instruments, such as the landfill charge for municipalities and extended producer responsibility of producers, have been used with the aim of motivating better waste management and supporting sorting and recycling. Financial guarantees and insurance are used to ensure liability for damage caused by the operation of landfills and to support reclamation and aftercare once landfills have been closed.

Among the economic instruments can also be included, for example, a discount for municipalities for landfilling municipal waste. Municipalities seek ways of reducing costs and are generally motivated to reduce the generation of municipal waste. The landfill charge is an important economic instrument. In the past, landfilling was essentially the cheapest method of waste disposal, although it ranks lowest in the waste management hierarchy. The increase in the charge has thus made this method of waste management less attractive and supported the development of technologies for managing waste higher up in the waste management hierarchy (facilities for energy recovery of waste, recycling technologies, etc.), some of which were implemented precisely thanks to the revenue from these charges. The instrument of extended producer responsibility has a markedly positive effect. It currently applies to packaging and packaging waste, but also to tyres, batteries, electrical equipment, and end-of-life vehicles. In the future, its further extension to other products is planned, e.g. furniture, sports equipment, DIY products for home and garden, or plastic toys. Another possible instrument is the expansion of deposit-refund systems. In the conditions of the Czech Republic and its very advanced system of separate collection, the use of deposit-refund systems is possible, but their benefits need to be carefully assessed. In the future, the expansion of the emissions trading system, subsidy support and eco-modulation will also have a major impact.

In the field of administrative instruments, measures have been used to increase the expertise of public administration staff and to strengthen inspection powers. Green public procurement and the support of desirable activities lead to waste prevention and the preference for environmentally friendly products.

Information instruments, such as the Waste Management Information System (WMIS), the Hazardous Waste Transport Register (SEPNO) and others, improve data collection, evaluation, and public awareness of waste management.

Voluntary instruments, such as voluntary agreements, ecolabelling and Environmental Product Declarations (EPD), contribute to increasing the quality of the activities of waste management entities and support corporate social responsibility.

Overall, it can be stated that the adopted instruments have the potential to contribute to more efficient and sustainable waste management in the Czech Republic; however, their effectiveness and impacts need to be continuously evaluated and adapted to current needs and developments in waste management.

4.1 Impacts of Economic Instruments on the Costs of Municipal Waste

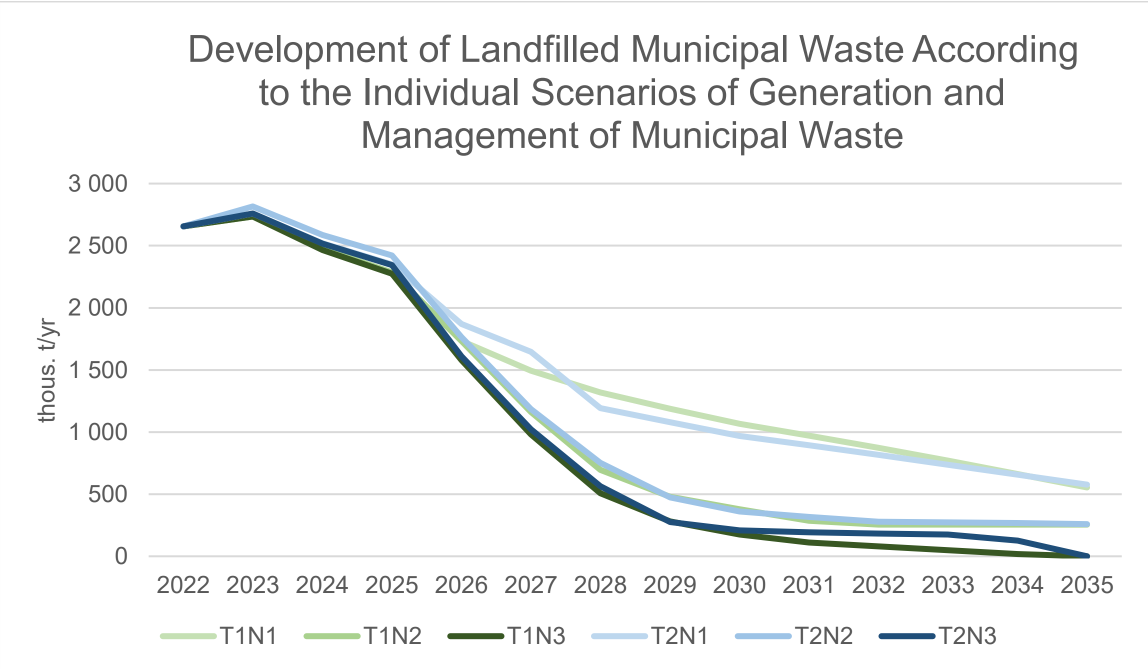
4.1.1 Assumption of the Impact of the Change in Landfill Charges on the Total Costs of Municipal Waste Management of Municipalities and Other Waste Holders

The assessment of the impacts of the change in landfill charges on the total costs of municipal waste was tested both for municipal waste originating from the municipal system and for municipal waste from other waste holders. The impact of changes to the fee base for the landfilling of recoverable and residual waste on the overall costs of municipal waste management was assessed.

As already mentioned above, statistically conclusive cost data exist only for municipal waste. For this reason, this assessment could only be carried out for municipal waste.

Within the model scenarios, on the basis of the development of separate collection, direct energy recovery, or the development of technologies for the further sorting of mixed and bulky waste, the amount of municipal waste to be landfilled was calculated. In the graph below, the development in the individual scenarios T1N1 to T2N3 is shown. In the graph, pairs of very close curves can always be seen, corresponding to the shares of landfilled municipal waste in 2035 of 0 %, 5 % and 10 %.

Graph 21: Development of Landfilled Municipal Waste According to the Individual Scenarios of Generation and Management of Municipal Waste (thousand t/year)



Source: own processing

As can be seen from the graph (Graph 21), management scenario N1 shows a gradual decline in landfilling.. By contrast, management scenarios N2 and N3 very dynamically reduce the need for landfilling until 2030, when the share of landfilled mixed municipal waste decreases. For the period 2030 to 2035, this is already a gradual decline in the amount of landfilled municipal waste. This fact is significantly reflected in the impact of the landfill charge for recoverable and residual waste on the costs associated with the management of municipal waste.

Another factor is the institute of exemption for inclusion in the fee base of the landfill charge rate for municipal waste, where the municipality, on the basis of the transitional provision in Act No. 541/2020 Sb., on Waste, in the case of waste that falls into the fee base for recoverable waste, claims from the landfill operator the right to have it classified among residual waste, with the charge amounting to only CZK 500 per tonne of waste This exemption applies to a limited quantity of municipal waste in relation to per capita generation per year.

Table*31*: *Limit for Obtaining an Exemption Pursuant to Sec. 157 of the Waste Act (t)*

Limit for Exemption (in t)	2021	2022	2023	2024	2025	2026	2027	2028	2029
Waste per capita	0.2	0.19	0.18	0.17	0.16	0.15	0.14	0.13	0.12

Source: own processing

Within each scenario of generation and management (T2N1–T1N3), the percentage share of municipal waste for each assessed waste type was calculated, which will be delivered to facilities for energy recovery of waste, waste sorting technologies, and landfills with or without a discount. These percentage shares were subsequently multiplied by the average expected prices of end facilities in the individual assessed years and the average annual price of the mix of end facilities was then calculated both for municipalities (influence of the sorting discount) and for other waste holders.

Within the modelling, the sensitivity of municipal waste costs to an increase in the legislatively defined fee bases of the landfill charge for recoverable waste and residual waste in the individual years was tested. A 100 % increase in these charge rates was tested.

Municipalities

The following tables (*Table 32* and

Table33) present the results of the comparison of the boundary scenarios T1N1 and T2N3 (only the boundary scenarios selected) under the landfill fee rates set by legislation and under a variant assuming a 100% increase in those fees.

Table 32: Comparison of Boundary Scenarios in Terms of the Expected Total Costs of Municipalities with Municipal Waste – 2022–2028 (CZK mil.)

Scenario	2022	2023	2024	2025	2026	2027	2028
T2N1*	14,141	16,989	19,253	20,605	21,711	22,469	23,617
T2N1**	15,366	18,255	20,554	21,980	22,966	23,615	24,499
T1N3*	14,141	16,952	19,168	20,462	21,586	22,422	23,456
T1N3**	15,366	18,203	20,430	21,774	22,654	23,098	23,794

Source: own processing

*Landfilling fees in accordance with legislation.

**Landfilling fees– 100% increase.

Table33: Comparison of Boundary Scenarios in Terms of the Expected Total Costs of Municipalities with Municipal Waste – 2029–2035 (CZK mil.)

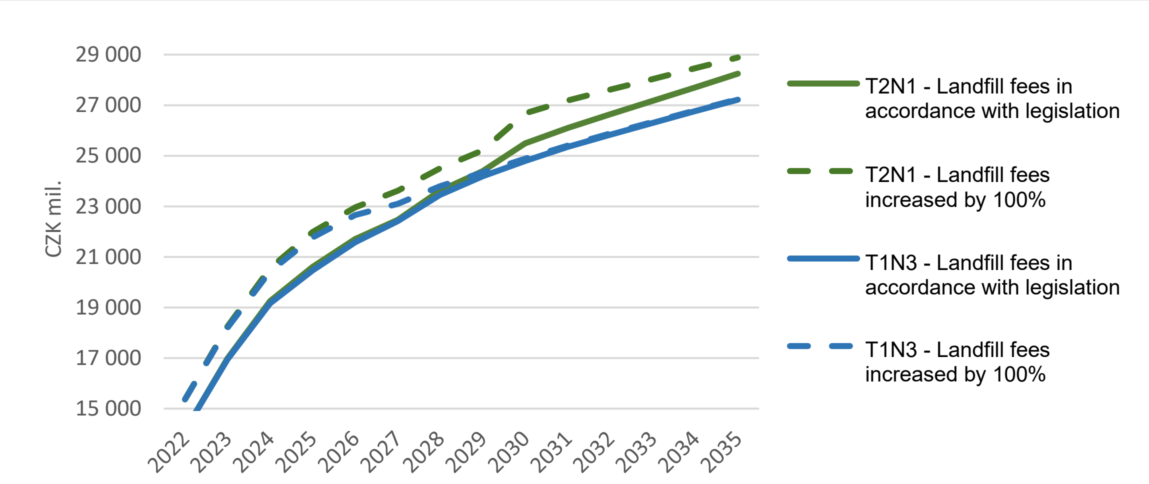
Scenario	2029	2030	2031	2032	2033	2034	2035
T2N1*	24,386	25,493	26,100	26,640	27,173	27,709	28,247
T2N1**	25,209	26,682	27,183	27,616	28,040	28,464	28,887
T1N3*	24,183	24,797	25,356	25,838	26,304	26,764	27,218
T1N3**	24,341	24,883	25,402	25,878	26,338	26,792	27,239

Source: own processing

*Landfilling fees in accordance with legislation.

**Increase in the Landfill Charge for Recoverable and Residual Waste by 100 %.

Graph 22: Development of Total Costs of Municipal Waste According to Individual Scenarios – Municipalities (CZK mil.)



Source: own processing

From the graph above it follows that the impact of a 100 % increase in landfill charges for recoverable and residual waste would manifest itself in the total costs of municipalities with municipal waste as an increase of up to 7 %, with a gradual decline in the influence of landfill charges on the total costs of municipalities with municipal waste, mainly due to the decrease in the amount of landfilled waste.

The comparison of the impact of the hypothetical 100 % increase in landfill charges on the individual scenarios of generation and management is evident from the following table (*Table 34*).

Table 34: Impact of a One-Hundred-Per-Cent Increase in Landfill Charges for Recoverable and Residual Waste on the Total Costs of Municipalities with Municipal Waste in the Key Years 2025, 2030 and 2035 (%)

Scenario	2025	2030	2035
T2N1	7%	5%	2%
T1N3	6%	0.3%	0%

Source: own processing

Other Holders

In the following tables (*Table 35* and *Table 36*) the results of the comparison of boundary Scenarios T1N1 and T2N3 and their impact on the total costs of other waste holders are presented. The difference compared to the situation where the municipality is the waste holder is that other waste holders cannot make use of the institute of exemption for inclusion in the fee base. Therefore, the impact of the increase in the charge is greater for these waste holders.

Table 35: Comparison of Boundary Scenarios in Terms of the Expected Total Costs of Other Waste Holders with Municipal Waste – 2022–2028 (CZK mil.)

Scenario	2022	2023	2024	2025	2026	2027	2028
T2N1*	5,611	6,078	6,829	7,249	7,400	7,527	7,727
T2N1**	6,339	6,804	7,657	8,175	8,179	8,252	8,289
T1N3*	5,611	6,061	6,791	7,185	7,290	7,362	7,521
T1N3**	6,339	6,782	7,603	8,085	7,962	7,818	7,792

Source: own processing

*Landfilling fees in accordance with legislation.

**Landfilling fees– 100% increase.

Table 36: Comparison of Boundary Scenarios in Terms of the Expected Total Costs of Other Waste Holders with Municipal Waste – 2029–2035 (CZK mil.)

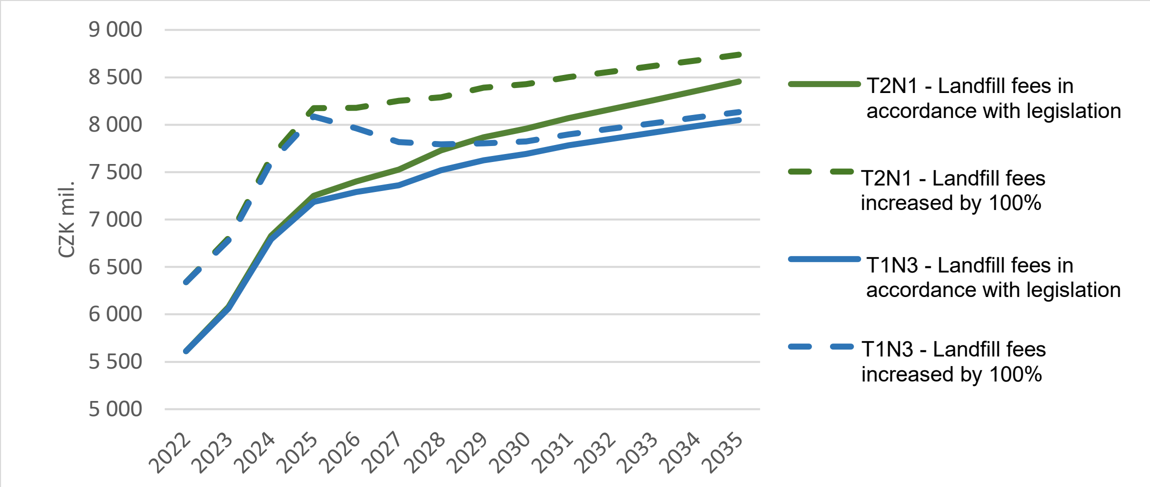
Scenario	2029	2030	2031	2032	2033	2034	2035
T2N1*	7,868	7,959	8,070	8,165	8,260	8,358	8,455
T2N1**	8,392	8,429	8,503	8,561	8,619	8,679	8,739
T1N3*	7,623	7,693	7,783	7,851	7,918	7,985	8,049
T1N3**	7,802	7,825	7,897	7,958	8,017	8,075	8,133

Source: own processing

*Landfilling fees in accordance with legislation.

**Landfilling fees– 100% increase.

Graph 23: Development of Total Costs of Municipal Waste According to Individual Scenarios – Other Waste Holders (CZK mil.)



Source: own processing

From the graph above it follows that the impact of a 100 % increase in landfill charges for recoverable and residual waste would manifest itself in the total costs of other waste holders with municipal waste as an increase of up to 13 %, with a gradual decline in the influence of landfill charges on the total costs of other waste holders with municipal waste, mainly due to the decrease in the amount of landfilled waste.

The comparison of the impact of the hypothetical 100 % increase in landfill charges on the individual scenarios of generation and management is evident from the table below (Table 37).

Table 37: Impact of a One-Hundred-Per-Cent Increase in Landfill Charges for Recoverable and Residual Waste on the Total Costs of Other Waste Holders with Municipal Waste in the Key Years 2025, 2030, 2035. (%)

Scenario	2025	2030	2035
T2N1	13%	6%	3%
T1N3	11%	1.6%	1.0%

Source: own processing

4.1.2 Assumption of the Impact of the Introduction of a Deposit-Refund System for PET Bottles and Beverage Cans

An intensively debated element of the municipal waste management system is the implementation of a deposit-refund system for PET bottles and metal beverage cans. According to the intention of the MoE [5], the system was to be implemented with effect from 1 January 2026. The legislative proposal passed through the LRC and was approved by the Government in autumn 2024, with discussions continuing in the Parliament of the CR.

5 https://mzp.gov.cz/cz/agenda/odpadove-hospodarstvi-a-cirkularni-ekonomika/zalohovani

The impact analysis of the implementation of the deposit-refund system has many specifics, reflecting uncertainties regarding the exact design of the system, the scope of competence of the operator of the deposit-refund system, the number of return points, etc. For this reason, analyses tend rather to focus on the impacts on individual stakeholders.

Impact study by CETA – Centre for Economic and Market Analyses (2022)

This study calculates the impacts of implementing deposit-refund, however without taking into account all obligations in their full extent under Article 8a of Directive 2008/98/EC of the European Parliament and of the Council on waste.

Impacts on Municipalities

From the perspective of the waste management system, the CETA analysis calculates the impacts of implementing deposit-refund on municipalities with the aim of finding an optimal system that will help meet the targets with corresponding (pre-known) costs.

Within the CETA analysis, the following assumptions were adopted:

- After the introduction of the deposit-refund system, all beverage PET bottles and aluminium cans will disappear from separate collection.
- The introduction of the deposit-refund system will be reflected in two scenarios:
  - The first (short-term) Scenario A represents a cost shock and the transfer of incurred economic costs (incl. lost revenues) to municipalities and towns.
  - The second (medium-term) Scenario B represents the accommodation of the shock, which manifests itself in rationalisation of behaviour and cost optimisation.
- The baseline data on the weight of packaging placed on the market, material prices, municipal waste management costs, separate collection, collection, and recycling of individual material components reflect the reality of 2021 (the latest available data at the time of preparation of the study).

The outputs of the analysis – calculated impacts – PET bottles are as follows

Short-Term Scenario A

- Before the introduction of deposits, municipalities operated with a deficit in waste management (plastics) of CZK –501,016,555.
- After the implementation of the deposit-refund system, the negative balance increased by CZK 263,105,505 to CZK –764,122,060.
- The change in balance represents:
  - a percentage economic impact on waste management of 2.31 %,
  - a percentage increase in all municipal costs (expenditures) of 0.07 %, and
  - an increase in the average waste fee of 25.10 CZK per capita/year

Medium-Term Scenario B

- Market optimisation occurs, and municipalities incur lower costs associated with the collection of sorted plastics (PET is not included).
- Before the introduction of deposits, municipalities operated with a deficit in waste management (plastics) of CZK –501,016,555.
- After the accommodation of the shock from the introduction of deposits, the negative balance would increase by CZK 123,706,628 to CZK –624,723,183, i.e. it would decrease compared to Scenario A.

- The change in balance represents:
  - a percentage economic impact on waste management of 1.01 %,
  - a percentage increase in all municipal costs (expenditures) of 0.03 %, and
  - an increase in the average waste fee of 11.8 CZK per capita

Calculated Impacts – Aluminium Cans

Scenario

- Before the introduction of deposits, municipalities operated with a deficit in waste management (metals) of –26,653,568 CZK (municipal costs minus the contribution of the Authorised Packaging Company for packaging components under the valid tariff).
- After the implementation of the deposit-refund system, the negative balance would increase by CZK 20,367,890 to CZK –47,021,458.
- The change in balance represents:
  - a percentage economic impact on waste management of 0.16 %,
  - a percentage increase in all municipal costs (expenditures) of 0.005 %, and
  - an increase in the average waste fee of 1.94 CZK per capita/year

The outputs of the model with input data for 2020 and 2021 show that the waste management system, specifically the separate collection system, is institutionally relatively stable – in year-on-year comparison, there were no dramatic cost shocks in total or unit costs that would affect the conclusions of the study on the impact of the implementation of the deposit-refund system on towns and municipalities in the Czech Republic from May 2022.

It can therefore be stated, **based on CETA (2022)**, that the **modelled estimates of the impact of the implementation of the deposit-refund system** with input data for 2021 are in line with the conclusions published with input data from 2020 and **do not represent insurmountable financial costs for municipalities.**

However, the proposal of the MoE provides for a compensation mechanism to saturate municipalities[6]. This instrument anticipates an impact on municipal budgets averaging 39 CZK per capita/year, which exceeds the calculated costs in both the short-term and medium-term scenarios.

ECONOMIC ANALYSIS OF DEPOSIT-REFUND FOR BEVERAGE PACKAGING (MoE in cooperation with the Authorised Packaging Company)

The amendment to the Packaging Act introduces mandatory deposits on selected beverage packaging. This amendment has impacts on the management of municipal waste.

The Czech Republic has a relatively well-developed system of separate collection of municipal waste, including plastic packaging. Less developed is the separate collection of metal consumer packaging, for two reasons. The first is the relatively low occurrence of metal packaging, which in the past did not require separate collection and only began to develop after 2015, i.e. with a twenty-year delay compared to the start of plastic collection. This development of metal waste collection is proceeding gradually and systematically, enabling both separate collection and multi-commodity collection, e.g. with plastics. In addition, in the future, machine sorting and treatment of mixed municipal waste and magnetic separation

6 https://mzp.gov.cz/cz/agenda/odpadove-hospodarstvi-a-cirkularni-ekonomika/zalohovani/kalkulacka-pro-obce

of all metals not primarily sorted are envisaged, which should contribute to recycling and the fulfilment of recycling targets both for municipal waste and for packaging metal waste.

The CR negotiated the possibility of postponing the fulfilment of certain recycling targets arising from the Packaging and Packaging Waste Directive and obtained an exemption for a temporarily lower target for aluminium packaging recycling (35 %) until 2029.

In view of the new Packaging and Packaging Waste Regulation, which will enter into force in 2025, it is clear that by around 2028 at the latest the CR will have to introduce some form of deposit-refund system for beverage packaging, specifically beverage plastic bottles and beverage cans. The key reason is that the CR will not be able to meet the target of 80 % separate collection of beverage cans for 2026, as the CR did not plan for such a development target for collection and does not have conditions prepared for its achievement within less than two years. Thus, under the new Regulation, the CR will be obliged to introduce deposit-refund for beverage packaging. Unfortunately, the exemption from the aluminium packaging recycling target cannot be applied to this target, as it relates exclusively to the recycling of aluminium packaging as a whole. This represents a change in waste management and economic impacts on individual entities in the waste management sector.

Authorised Packaging Company

The Authorised Packaging Company EKO-KOM is obliged to ensure the fulfilment of the targets arising from the Packaging Act and from the Authorisation issued by the MoE. These prescribe targets both for the take-back itself and for ensuring the recovery of packaging in specified percentages. EKO-KOM, as the AOS, assumes responsibility for achieving the prescribed targets on behalf of its clients on the basis of a collective fulfilment agreement.

The AOS must meet all obligations imposed on extended producer responsibility systems, as set out in Article 8a of Directive 2008/98/EC on waste. Article 8a obliges the AOS, in fulfilling recycling targets, to cover all standard costs associated with the collection and recycling of packaging waste, even if these costs increase as a result of changed conditions. This applies both to municipalities and to facilities for sorting/further sorting of waste. It applies, for example, in the case of an economic recession and a fall in the prices of secondary raw materials. The same applied when costs increased as a result of changes in waste legislation in 2021, and it will also apply to the introduction of deposit-refund, which will shift part of the waste from the municipal waste management system to another method of collection. Therefore, **the response of the AOS to the introduction of deposits will be an adjustment of payments to sorting lines as well as municipalities, so that they reflect possible losses directly associated with the introduction of deposits, increased unit costs or other economic impacts related to the sorting and recycling of packaging.**

ECONOMIC IMPACTS

The impact analysis works on the assumption of maintaining the obligations and conditions of Article 8a of the Waste Directive, on the basis of which the AOS will adjust its payments to municipalities and sorting lines so that the impact of the introduction of deposit-refund on municipal budgets will ultimately be neutral. The economic analysis is carried out on the basis of today's waste management parameters and the parameters of the draft amendment to the Packaging Act, i.e. deposit-refund. However, the principles of cost reimbursement by the AOS will apply regardless of what the parameters of waste management will be at the time of the actual introduction of deposits.

The amendment envisages that municipalities will receive a 15 % share of unclaimed deposits on packaging that is not returned to shops for recycling. This share is an important item that will compensate municipalities for losses caused by the reduced efficiency of the system. It is precisely this revenue that compensates for the reduced share of the AOS in financing separate collection, resulting from the reduced content of packaging in the sorted waste. Thanks to this additional revenue, the impact on municipal budgets remains neutral. On the other hand, it can be expected that in the first year of operation of the deposit-refund system its performance will not reach the expected 90 % return rate of packaging. In such a case, municipal revenue will be higher than the analysis assumes, which should certainly compensate for the fact that in the first year it will not be possible to optimise the collection network and, depending on the return rate, may even lead to a temporary improvement in the municipal balance.

The amendment also envisages that the AOS will be responsible also for so-called advertising leaflets. If this happens, it will represent additional revenue for the AOS, and municipal revenues from the AOS, i.e. also the AOS costs, will increase by the reimbursement for sorted leaflets, which, as in the case of packaging, will correspond to the standard costs of sorting. In line with the principle of non-profitability of the AOS, this additional revenue will not have any impact on the economic balance of the AOS, and thus not on the payments of producers for packaging placed on the market. On the contrary, for municipalities this would represent additional revenue from the AOS beyond the aforementioned cost compensation for separate collection of packaging waste. This revenue would therefore have a positive impact on their waste management budgets.

Overall, therefore, the amendment to the Packaging Act, if adopted in the proposed wording, should have rather a positive impact on municipal costs, since all increased costs resulting from the diversion of beverage packaging into the deposit-refund system will be compensated roughly one quarter by the municipal share of unclaimed deposits and roughly three quarters by the AOS, which will also reimburse municipalities for the separate collection of leaflets.

IMPACT ANALYSIS

Starting Points:

- The quantity of sorted plastics is around 180 thousand tonnes per year, the weight proportion of packaging in these plastics is 70 %, and specifically the occurrence of beverage PET in this waste is around 17 % of the total amount of plastics.
- The selling price of an average tonne of sorted PET is around CZK 10,000.
- The cost to municipalities of one tonne of sorted plastics is CZK 10,000, including the cost of delivery of the waste to the sorting line.
- The efficiency of sorting saleable PET from plastic waste at the sorting line is around 80 %;
- in the long term, municipalities cover only 30% of the costs of plastic sorting from their own resources, as the average costs associated with packaging are reimbursed to them by the authorised packaging company (AOS), which covers a proportional share of the costs corresponding to the presence of packaging in the sorted waste, i.e. the so-called packaging component costs – currently 70%.

On the basis of these starting points, the economic impact of deposit-refund on sorting lines and municipalities was quantified.

Impacts on SORTING LINES

Sorting lines receive 180 thousand tonnes of plastics, of which 17 % are sortable PET bottles, i.e. 30,600 tonnes, which have a market value of CZK 306 million. With 80 % efficiency of their sorting, the revenue of sorting lines from sales is about CZK 245 million. In the case of the exclusion of PET from the waste stream into the deposit-refund system, the revenues of sorting lines will decrease by this CZK 245 million and at the same time the amount of waste received will decrease.

This will have two simultaneous effects:

- a loss of revenue per tonne of plastics received for sorting of CZK 245 million / 180 thousand, i.e. CZK 1,350.
- total costs of sorting lines will not be spread over 180 thousand tonnes of incoming plastics, but only over 150 thousand tonnes. The fee per tonne of plastics received should therefore be higher, in the ratio of 180 / 150 compared to the present. Thus, from today's approximately CZK 2,000 per tonne, it should rise to CZK 2,400, i.e. by CZK 400 (in reality it should be somewhat less, since costs should decrease slightly, as the processing of a smaller amount of waste should lower labour and energy costs).

In total, it can therefore be expected that the price per tonne of plastics entering the sorting line should increase by a maximum of CZK 1,750. Into this, however, enters the role of the AOS, which pays sorting lines the costs associated with the treatment of the packaging component of the waste, which today is 70 % and in the future, after the introduction of deposits, will fall to about 64 %. Thus, municipalities will bear an additional cost transferred from the sorting lines in the form of an increase in the fee for the acceptance of waste amounting to 36 % of CZK 1,750, i.e. about CZK 630 per tonne of plastics.

Impacts on MUNICIPALITIES

From the above input parameters it follows that from the sorted waste in municipalities today, one tonne of plastics contains about 170 kg of PET bottles, a further 530 kg of other packaging and 300 kg of non-packaging plastics.

1) The packaging component, for which the AOS is responsible, is currently 70 %, i.e. (170+530) / 1,000, and in the future it will be 64 %, i.e. 530 / (530+300).
2) At present the AOS covers 70 % of costs, i.e. pays the full costs for 126 thousand tonnes of sorted plastics, while municipalities pay the costs for 54 thousand tonnes of the non-packaging component. In the future, the AOS will cover only 64 % of the costs of separate collection of plastics, i.e. for 96 thousand tonnes of sorted plastics, while municipalities will still cover the costs for 54 thousand tonnes of the non-packaging component.
3) At the same time, municipalities will receive 15 % of unclaimed deposits, which, with 90 % of PET bottles returned and 1.6 billion PET bottles sold, will represent, at a deposit of CZK 4, 15 % of CZK 640 million per year, i.e. about CZK 96 million. Recalculated to 54 thousand tonnes of the non-packaging component, municipalities will thus receive additional revenue from unclaimed deposits of CZK 1,780 per tonne of sorted non-packaging waste.
4) If the costs per tonne of sorted plastics were to increase only due to the reduction in revenues of sorting lines, and thus the increase in the fee charged to municipalities for waste acceptance at the sorting facility by CZK 630, then the cost per tonne for municipalities should increase from today's CZK 10,000 to CZK 10,630. This should be sufficiently compensated by the additional revenue of municipalities from the share in unclaimed deposits, which should be CZK 1,150 higher than the expected increase in costs.

The economic impacts, however, are somewhat more complex. In particular, the reduction in the amount of waste by 17 % from 180 thousand tonnes to 150 thousand tonnes does not automatically imply a reduction in costs in the same proportion, and therefore the average cost per tonne will not remain the same. Approximately 30 % of the costs of collecting sorted plastics are fixed costs associated with the very existence of the collection network, which will not decrease with the reduction in quantity. The average municipal cost of separate collection of plastics can be estimated as the difference between today's total costs of CZK 10,000 per tonne and the payment of CZK 2,000 to the sorting line for acceptance of waste, i.e. around CZK 8,000 per tonne. Of this CZK 8,000, CZK 5,600 is the actual collection cost, which will remain the same, and CZK 2,400 per tonne are fixed costs, which will be spread over fewer tonnes in the ratio of 180 / 150. This cost component will therefore increase to 180 / 150 x 2,400, i.e. CZK 2,880. The unit cost per tonne will thus increase by CZK 480. Together with the increase in the fee for plastics acceptance at the sorting line by CZK 630, this results in a cost per unit tonne of collected plastics of CZK 11,110.

It still holds, however, that the additional revenue from unclaimed deposits of CZK 1,780 per tonne of the non-packaging component is higher than the cost increase of CZK 1,110. This, however, is on the assumption that it is possible to maintain the actual collection cost of CZK 5,600 per tonne at the original level, which would apply if operating costs decreased linearly with the reduction in waste, i.e. decreased by 17 %, corresponding to the occurrence of PET bottles in separate collection.

In real practice, however, this will unfortunately not be the case, because it is not always possible to proportionally reduce the collection frequency in line with the decrease in waste quantities, for many logistical and hygienic reasons. From the simulation models prepared by the AOS it follows that the collection frequency will not decrease by the intuitively expected 17 % together with the 17 % decrease in the amount of sorted waste but will probably decrease by only 6 or 7 %.

In that case, the unit operating cost of collection will increase from the current CZK 5,600 to a value determined by the ratio of the decrease in collection frequency to the decrease in waste quantity, i.e. with a frequency decrease of 6.5 % to 93.5 % and a waste quantity decrease of 17 % to 83 %, it will be 5,600 x 93.5 / 83 = CZK 6,308 operating cost of collection per tonne of collected waste, i.e. CZK 708 more.

If it were not possible to reduce the collection frequency at all, then the unit operating costs would increase to 5,600 x 100 / 83 = CZK 6,747, i.e. by as much as CZK 1,147 per tonne.

In fact, it can be expected that the average cost per unit of sorted waste will increase from today's CZK 10,000 per tonne by CZK 630 due to the increase in the price at which the sorting line accepts waste, by CZK 708 due to the imperfect adjustment of the collection frequency to the amount of waste collected, and by CZK 480 per tonne due to the distribution of fixed costs of the collection network over a smaller quantity of collected waste.

In total, the cost per tonne will increase by CZK 1,818 per tonne, which is more than the additional revenue of municipalities from the share of unclaimed deposits, which is CZK 1,780 per collected non-packaging tonne.

If it were not possible to reduce the collection frequency even by the assumed 6 to 7 %, which could occur during the first year after the introduction of deposits, then the increase in unit costs for municipalities could reach up to CZK 2,256 per tonne.

On the other hand, the calculation of revenue from the AOS per tonne of collected waste is also more complex, as it also consists of a fixed component, which is the capitation payment of CZK 24 per capita, and a variable component, which is the payment per tonne sorted. This reflects the fact of the existence of fixed costs of separate collection associated with the very existence of the collection network. This capitation payment amounts to a total of CZK 24 times the number of inhabitants, 10.9 million, i.e. CZK 262 million in total. If, therefore, the fixed costs of municipalities per tonne of waste, as mentioned above, increase from CZK 2,400 to CZK 2,880 per tonne, the capitation payment must similarly increase by the same 20 %, i.e. to CZK 314 million. That is CZK 52 million more. However, it holds true that 64 % of this increase will be compensated by a proportional reduction of the variable component, because the ratio of fixed and operating costs of sorting will change. As a result, municipalities will gain only 36 % of CZK 52 million, i.e. roughly CZK 19 million, for the financing of the collection network. Recalculated to 54 thousand tonnes of non-packaging plastic waste, this is approximately CZK 350 per tonne.

In the final sum, the AOS will continue to reimburse municipalities for the full average costs of the packaging component, which will fall from 70 % of sorted plastics to 64 %. **The costs of municipalities per tonne of the non-packaging component will rise from the current CZK 10,000 per tonne to a total of CZK 11,818 per tonne. Against this, municipalities will receive CZK 1,780 per tonne as their share of unclaimed deposits from the operator of the deposit-refund system and, in addition, about CZK 350 per tonne from AOS EKO-KOM in the form of an increased capitation payment.**

Overall, therefore, a slightly positive impact on the costs of non-packaging plastics can be expected, since against an increase in costs of CZK 1,818 municipalities will gain CZK 2,130 more revenue per non-packaging tonne. It is assumed that the frequency of separate collection of plastics will, after all, be reduced.

Impacts on INHABITANTS

Recalculated per capita, and assuming the collection of 54 thousand tonnes of the non-packaging component, the total impact on municipalities should range from a reduction in citizens' payments of CZK 1.54 up to an increase in citizens' payments of CZK 0.62 per year.

Impacts on AOS

The EKO-KOM system, in cooperation with its partners, annually sorts and forwards for recycling and recovery almost 1 million tonnes of packaging waste. More than 920 thousand containers for sorted commodities are used for separate collection on the streets in municipalities and directly at households. 75 % of the population of the CR actively participates in sorting.

For AOS EKO-KOM, the impact of the introduction of deposits will in the first step be reflected in the same way as for municipalities.

1) Its unit costs for sorting plastic packaging will increase in the same way, from the current CZK 10,000 per tonne of sorted packaging collected to the expected CZK 11,818 to CZK 12,256 per tonne.
2) At the same time, however, the amount of sorted plastic packaging will fall from 126 thousand tonnes to 96 thousand tonnes. Its collection costs will therefore decrease from the current CZK 1,260 million to CZK 1,135 million to CZK 1,176 million. They will thus fall by CZK 84 to 125 million.
3) At the same time, however, its costs for the treatment of packaging waste will rise by CZK 1,120 per tonne, i.e. by a total of CZK 108 million.

The costs of the AOS will thus remain roughly the same as they are today.

However, this is only a theoretical calculation, because the main task of the AOS remains not only to reimburse municipalities for the costs associated with separate collection, but also to ensure sufficient sorting of waste for recycling at very volatile secondary raw material prices, and therefore its costs may vary significantly depending on the current state of the market.

Impacts on PRODUCERS OF GOODS packaged in plastics, other than beverages

If the costs of the AOS remain the same, but the amount of packaging contributing to their reimbursement decreases by 28 %, corresponding to the amount of beverage PET packaging transferred into the deposit-refund system, then the average increase in fees would intuitively be 1/0.72 – 1, i.e. 40 %. This will not happen, however, because the selling prices of sorted PET packaging are already today reflected in the lower rates applied to beverage PET packaging within the framework of eco-modulation. Therefore, the impact of the change on other non-deposit packaging will be limited only to the increased unit costs of collection and treatment as a result of the lower amount of packaging waste, in which the fixed costs of separate collection and treatment are reflected. The expected average increase in fees for plastic packaging as a result of the introduction of deposits will therefore range between 26 and 28 %, depending on how successfully the collection frequency can be optimised.

Impacts on the Collection and Recycling of METALS

The sorting of metals in municipalities is not yet very developed; the deposit-refund of beverage cans will naturally reduce the amount of sorted metal waste by about 20 to 30 %. Thus, the share of the AOS in financing this commodity will also decrease, because the share of packaging in sorted waste will fall by about one fifth.

On the other hand, the not very developed collection network and the relatively small amount of this waste create the assumption that the separate collection system will react to the decrease in quantity with a corresponding change in collection frequency. This makes the situation for metals different from plastics.

Another difference is the fact that the price of sorted waste will not change significantly by the exclusion of only beverage cans. The total costs of separate collection of metals should therefore fall by about 10 to 20 %, while the unit price per tonne of sorted waste should increase by about 10 %.

It is difficult to estimate the exact change in the costs of separate collection and further sorting because the reaction of many municipalities to the decrease in the quantity of metal waste will probably be a transition to multi-commodity collection with plastics.

At the same time, the share of the AOS in covering total costs should decrease, because the packaging component will decrease.

Together with the relatively low costs of sorting compared with plastics, this leads to the conclusion that the impact of the introduction of deposit-refund for beverage cans on the costs of separate collection will be very small. For the whole CR, it will mean a decrease in total costs in the order of several million, probably around CZK 5 million. At the same time, the share of the AOS in these costs will fall by about CZK 10 million as a result of the decrease in the packaging component.

The impact on municipal budgets will therefore be rather negative, in the range from zero to CZK 1 per capita. This impact will be sufficiently compensated by the 15 % share of municipalities in unclaimed deposits for cans.

5. Expected Development of Municipal Waste Costs According to Defined Scenarios of Their Generation and Management

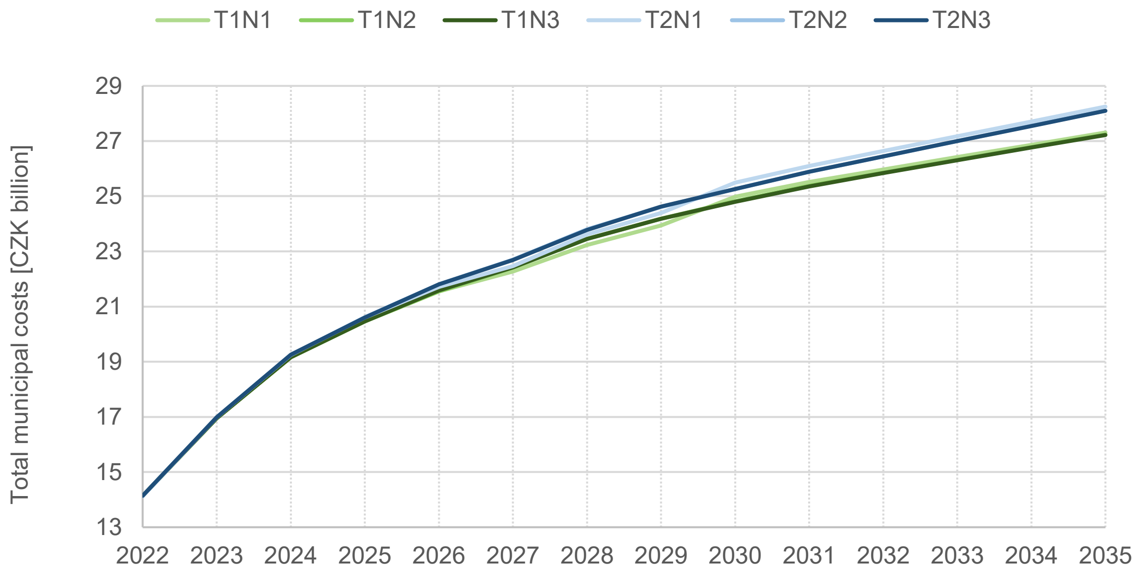
Based on the input data, the costs associated with the management of individual municipal waste streams were calculated both at the level of municipalities and other waste holders, for the defined scenarios of generation and management of individual municipal waste streams. The outputs of the analyses carried out are presented in the following text.

5.1 Total Costs of Municipalities for Municipal Waste

5.1.1.1 Total Costs of Municipalities – Management of Municipal Waste

The following graph shows the costs from 2022 and the projected development of these costs by 2035. These are the costs of municipalities for the management of municipal waste. This graph shows all six scenarios.

Graph 24: Costs of Municipalities According to Individual Scenarios of Generation and Management of Municipal Waste (CZK billion)



Source: own processing

A detailed analysis shows that the highest costs are reached in scenario T2N1, while the lowest costs are represented by scenario T1N3. In general, it can be stated that the generation scenarios T2 show slightly higher costs compared to the generation scenarios T1. This is due to the higher amount of landfilled waste in sub-group 20 03 throughout the evaluation period.

In all scenarios, the total costs of municipalities for the management of municipal waste increase. In 2035, it can be expected that the total costs of municipalities for municipal waste will range between CZK 27–28 billion, which is essentially double the 2022 level.

In the following table (*Table 38*) presents the aggregated data of the individual scenarios so that the range of calculated values is clear and the expected trend of the development of the total costs of municipalities for municipal waste can be determined. The table does not present all six scenarios, but only the scenario with the lowest and highest costs and the average value. The table also contains the differences between the scenarios with the highest and lowest costs.

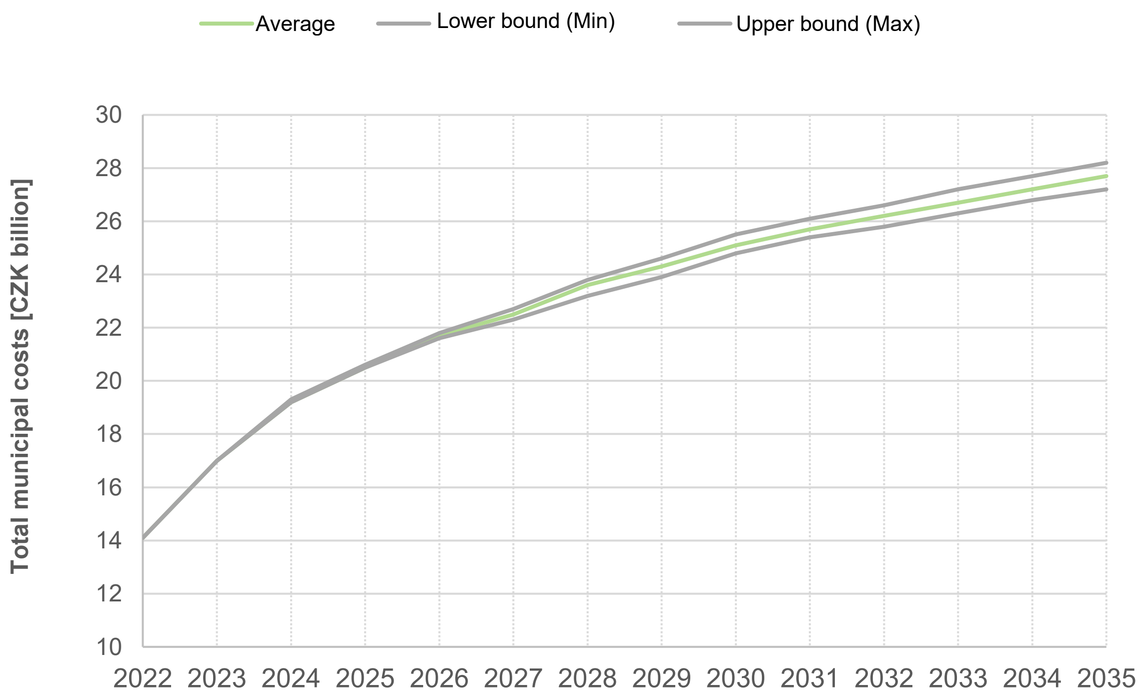
Table 38: Summary of Scenarios for Total Costs of Municipalities for Municipal Waste (CZK billion)

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Min	14.1	17.0	19.2	20.5	21.6	22.3	23.2	23.9	24.8	25.4	25.8	26.3	26.8	27.2
Max.	14.1	17.0	19.3	20.6	21.8	22.7	23.8	24.6	25.5	26.1	26.6	27.2	27.7	28.2
Difference max-min	0.0	0.0	0.1	0.1	0.3	0.4	0.6	0.7	0.7	0.7	0.8	0.9	0.9	1.0
Average	**14.1**	**17.0**	**19.2**	**20.5**	**21.7**	**22.5**	**23.6**	**24.3**	**25.1**	**25.7**	**26.2**	**26.7**	**27.2**	**27.7**

Source: own processing

A graphical representation of the table is shown in the following graph (*Graph 25*).

Graph 25: Scenarios of the Development of Total Costs of Municipalities for Municipal Waste by 2035 (CZK billion)



Source: own processing

The difference in the total projected costs is caused by the change in the setting of the parameters of generation and management. Within the scenarios T1N1–T2N3, this difference represents 4 % in 2035. A much more significant impact on the growth of costs is inflation and its reflection in the prices of municipal waste management.

Impact of Inflation on the Development of Costs of Municipalities for Municipal Waste Management

Within the analysis, the impact of inflation on the total costs of municipalities for municipal waste was tested. This test was carried out on scenario T1N1. The results are presented in the following tables (Table 39 and Table 40).

Table 39: Development of the Total Costs of Municipalities for Municipal Waste in the Variant with Inflation Considered as Defined in the Analysis Input and Without Inflation Considered (CZK billion) – 2022–2028

Scenario	2022	2023	2024	2025	2026	2027	2028
T1N1*	14.1	17.0	19.2	20.5	21.6	22.3	23.2
T1N1**	14.1	15.2	15.5	15.9	16.3	16.4	16.8
Difference	0.0	1.8	3.7	4.6	5.3	5.8	6.4

Source: own processing

*Scenario T1N1 with Inflation Considered.

**Scenario T1N1 without Inflation Considered.

Table 40: Development of the Total Costs of Municipalities for Municipal Waste in the Variant with Inflation Considered as Defined in the Analysis Input and Without Inflation Considered (CZK billion) – 2029–2035

Scenario	2029	2030	2031	2032	2033	2034	2035
T1N1*	23.9	25.0	25.5	26.0	26.4	26.9	27.3
T1N1**	17.0	17.5	17.5	17.4	17.3	17.2	17.1
Difference	7.0	7.5	8.0	8.6	9.1	9.7	10.2

Source: own processing

*Scenario T1N1 with Inflation Considered.

**Scenario T1N1 without Inflation Considered.

The tables clearly show a very significant impact of inflation. In this case, by 2035 the increase in the total costs of municipalities due to inflation amounts to 60 %. The comparison is made on scenario T1N1. Thus, the rate of inflation will in the future significantly influence the development of prices for individual activities and methods of waste management and thereby be reflected in the costs of municipalities for municipal waste.

5.1.1.2 Unit Costs of Municipalities – Management of Municipal Waste

For the purpose of assessing the impact of the costs of municipalities for municipal waste on citizens, recalculations of the total costs to the average number of inhabitants of the CR in each evaluated year were carried out. The following table presents the aggregated data of the individual scenarios. The table does not present all six scenarios, but only the scenario with the lowest and highest costs and the average value. The table also contains the differences between the scenarios with the highest and lowest costs.

Table*41: Summary of Scenarios for Total Costs of Municipalities for Municipal Waste (CZK per capita)*

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Min	1,343	1,566	1,757	1,875	1,984	2,061	2,162	2,227	2,307	2,359	2,404	2,448	2,492	2,535
Max.	1,345	1,569	1,765	1,888	2,008	2,101	2,215	2,291	2,372	2,428	2,479	2,529	2,580	2,631

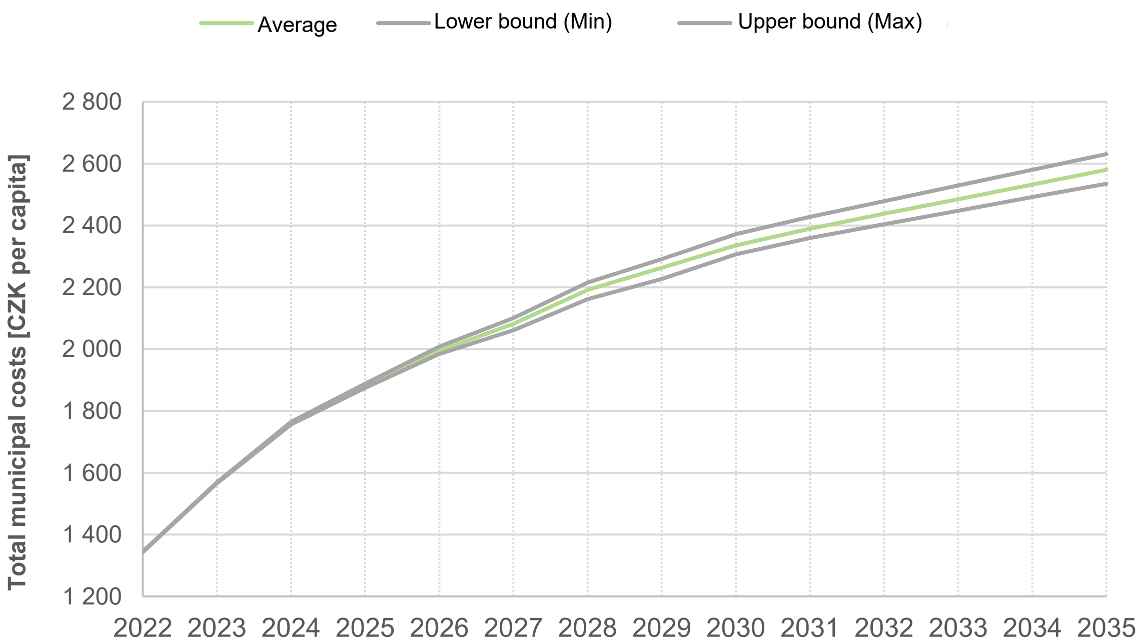
Difference max-min	1.4	3.4	7.8	13.3	23.8	40.3	52.7	63.7	64.8	69.2	74.7	80.9	88.0	95.9
Average	1,344	1,567	1,761	1,881	1,995	2,082	2,192	2,263	2,336	2,390	2,438	2,485	2,533	2,580

Source: own processing

On the basis of the outputs of the analysis carried out, an increase in the average unit costs of municipalities for municipal waste management of around CZK 700 per capita can be expected in the period 2025–2035. This represents an increase in unit costs by almost 40 % by 2035 compared with the projected unit costs in 2025. As already stated above, inflation has a significant influence on the growth of these costs. Scenario differences can contribute up to 4 % to the growth of costs.

A graphical representation of the table is shown in the following graph.

Graph 26: Scenarios of the Development of Total Costs of Municipalities for Municipal Waste Management by 2035 (CZK per capita)



Source: own processing

Impact of Inflation on the Development of Unit Costs of Municipalities for Municipal Waste Management

Within the analysis, the impact of inflation on the unit costs of municipalities for municipal waste per capita was tested. This test was carried out on scenario T1N1. The recalculated results of the impacts of the costs of municipalities for municipal waste per capita are shown in the table below.

Table*42: Development of Unit Costs of Municipalities for Municipal Waste per Capita in the Variant with Inflation Considered as Defined in the Analysis Input and Without Inflation Considered (CZK per capita). (CZK per capita)*

Scenario	2022	2023	2024	2025	2026	2027	2028
T1N1*	1,345	1,566	1,757	1,875	1,984	2,061	2,162

T1N1**	1,345	1,399	1,422	1,457	1,497	1,520	1,563
Difference	0	166	335	418	488	541	599

Source: own processing

*Scenario T1N1 with Inflation Considered.

**Scenario T1N1 without Inflation Considered.

Table 43: Development of Unit Costs of Municipalities for Municipal Waste per Capita in the Variant with Inflation Considered as Defined in the Analysis Input and Without Inflation Considered (CZK per capita). (CZK per capita)

Scenario (average cost)	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
T1N1*	2,227	2,325	2,374	2,417	2,459	2,501	2,544
T1N1**	1,578	1,626	1,625	1,619	1,611	1,602	1,593
Difference	650	699	749	798	848	899	951

Source: own processing

*Scenario T1N1 with Inflation Considered.

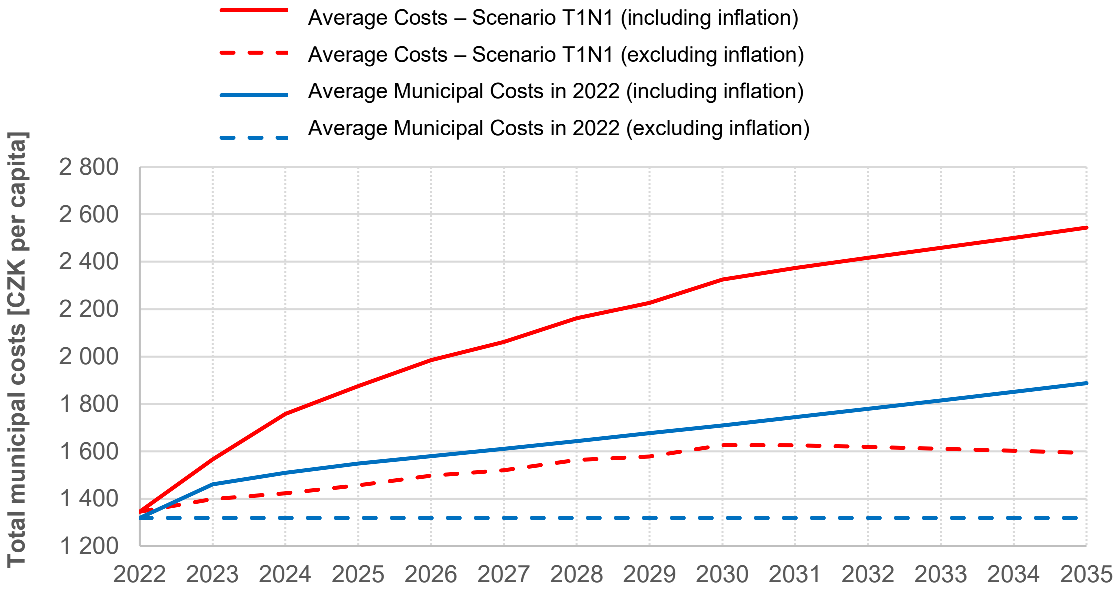
**Scenario T1N1 without Inflation Considered.

As already stated above, inflation contributes significantly to the growth of unit costs per capita. According to the calculation presented in the previous table (*Table 43*), this increase represents almost 60 % in 2035.

The following graph shows and compares the development of the total unit costs of municipalities for municipal waste for Scenario T1N1 in the variant with and without inflation considered. Furthermore, the graph compares the development of the total unit costs of municipalities for municipal waste in the case of maintaining the municipal waste management system at the 2022 level, in the variant with and without inflation considered. The growth of year-on-year inflation is defined in the analysis input. The graph therefore shows:

- Development of average costs per capita in Scenario T1N1 including inflation (red line)
- Development of average costs per capita in Scenario T1N1 without inflation (red dashed line)
- Average costs per capita in 2022 including inflation (blue line)
- Average costs per capita in 2022 without inflation (blue dashed line)

Graph 27: Scenarios for the development of total municipal costs of municipal waste management by 2035, reflecting the impact of inflation under scenario T1N1 and under a scenario assuming the status quo in municipal waste management as of 2022 (CZK per capita)



Source: own processing

If the state of waste management in 2022 were maintained, the costs of municipal waste management, with the assumed inflation considered, would increase by CZK 670 per capita in the period 2022–2035.
In the case of the development of waste management according to Scenario T1N1, the costs of municipal waste management, with the assumed inflation considered, would increase between 2022 and 2035 by CZK 1,200 per capita.
The difference between these two values can be attributed to the improvement of waste management in order to achieve the objectives of the WMP CR in the given scenario of generation and management of municipal waste by municipalities.

Without taking into account the impact of inflation on the price of municipal waste management, in Scenario T1N1 the difference in unit costs per capita between 2022 and 2035 is only CZK 250.

5.1.1.3 Costs Broken Down by Municipal Waste Sub-streams – Municipalities

This chapter presents the aggregated costs of defined sub-streams of municipal waste originating from municipal systems.
For clarity, the aggregation of waste into three main sub-streams is presented in relation to the subsequent method of management. The inclusion of waste in the individual sub-streams is shown in the following table.

Table44: *Aggregation of Municipal Waste into Sub-streams According to the Predominant Method of Management*

Waste	Dominant Method of Management	Name of Sub-stream
Paper	Treatment and Recycling	Separately Collected Waste
Plastics	Treatment and Recycling	Separately Collected Waste

Glass	Treatment and Recycling	Separately Collected Waste
Metal	Treatment and Recycling	Separately Collected Waste
Textiles	Treatment and Recycling	Separately Collected Waste
Biowaste from Gardens and Parks	Treatment and Recycling	Separately Collected Waste
Biowaste from Kitchens	Treatment and Recycling	Separately Collected Waste
Edible Oils	Treatment and Recycling	Separately Collected Waste
Wood	Treatment and Recycling	Separately Collected Waste
Hazardous Waste	Disposal	Hazardous Waste
Waste from Marketplaces	Energy Recovery/Disposal	Other Waste
Street Sweepings	Energy Recovery/Disposal	Other Waste
Bulky Waste	Energy Recovery/Sorting/Disposal	Other Waste
Mixed Municipal Waste	Energy Recovery/Sorting/Disposal	Other Waste
Other Municipal Waste Not Listed Above	Energy Recovery/Disposal	Other Waste

Source: own processing

The following table shows the increase in costs for items included in the sub-stream Separately Collected Waste. The table does not present all six scenarios, but only the scenario with the lowest and highest costs and the average value. The table also contains the differences between the scenarios with the highest and lowest costs.

Table45: *Summary of Scenarios of Municipal Costs for Municipal Waste Management within the Sub-stream Separately Collected Waste (CZK billion)*

	2022	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Minimum	5	6	8	8	9	10	11	11	12	13	14	14	15	16
Maximum	5	7	8	9	9	10	11	12	13	13	14	15	16	17
Difference max-min	**0.0**	**0.0**	**0.1**	**0.1**	**0.2**	**0.3**	**0.3**	**0.4**	**0.5**	**0.5**	**0.6**	**0.7**	**0.8**	**0.8**
Average	**5**	**6**	**8**	**9**	**9**	**10**	**11**	**12**	**12**	**13**	**14**	**15**	**16**	**16**

Source: own processing

A significant impact on the growth of costs associated with the sub-stream Separately Collected Waste is the projected increase in the amount of sorted separately collected waste within this sub-stream, and the costs thereby incurred in ensuring the collection, transport, and transfer of this waste for subsequent management. The growth of these costs reaches CZK 4 billion in the period 2025–2030, and in the period 2030–2035 this growth represents a further CZK 4 billion.

Overall, according to the analysis, the costs of municipalities for the management of the sub-stream Separately Collected Waste will increase by CZK 8 billion between 2025 and 2035. The fundamental driver of this cost growth is the projected increase in the amount of sorted waste within the sub-stream Separately Collected Waste.

The following table presents the costs of municipalities for the management of waste included in the sub-stream Hazardous Municipal Waste. The total costs are negligible in all scenarios.

Table46: *Summary of Scenarios of Municipal Costs for Waste Management within the Sub-stream Hazardous Municipal Waste (CZK billion)*

Scenario	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**

T1N1-T2N3	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

Source: own processing

The costs of municipalities associated with the sub-stream Hazardous Municipal Waste are negligible compared with other sub-streams. In the long term, they will stagnate.

The following table shows the increase in municipal costs for waste included in the sub-stream Other Waste. The table does not present all six scenarios, but only the scenario with the lowest and highest costs and the average value. The table also contains the differences between the scenarios with the highest and lowest costs.

Table47: *Summary of Scenarios of Municipal Costs for Municipal Waste Management within the Defined Sub-stream Other Waste (CZK billion)*

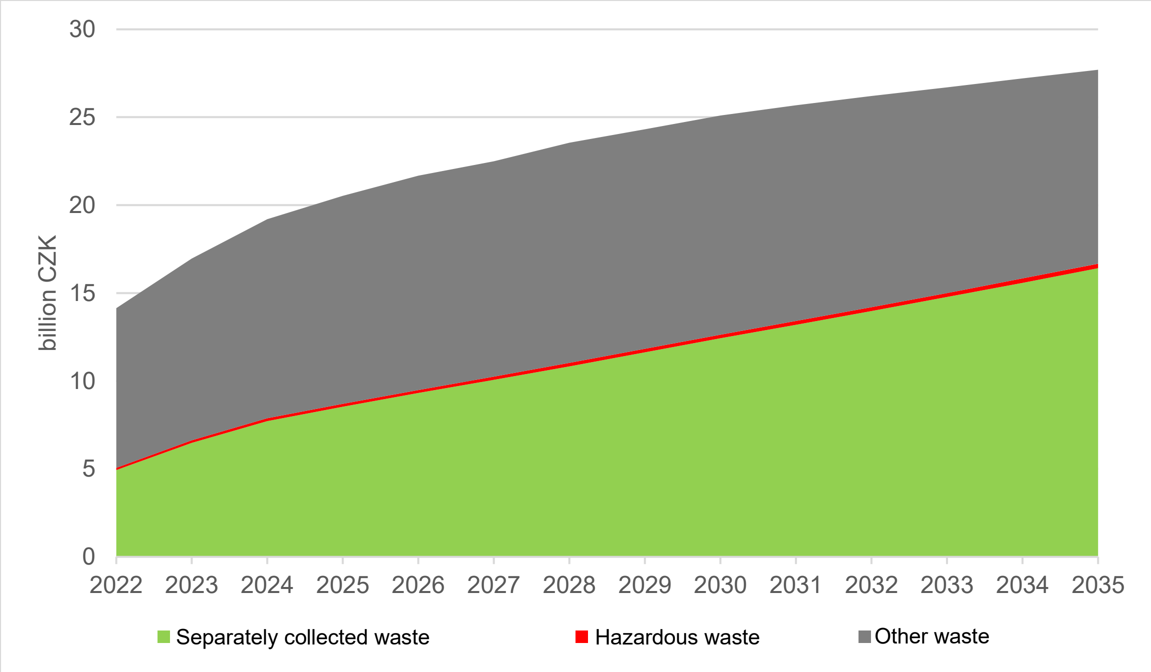
	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Minimum	9.1	10.3	11.2	11.7	12.0	11.9	12.0	11.9	11.9	11.7	11.3	11.0	10.6	10.1
Maximum	9.1	10.4	11.4	12.0	12.4	12.6	12.9	13.0	13.1	13.0	12.7	12.5	12.3	12.0
Difference max-min	**0.0**	**0.1**	**0.2**	**0.3**	**0.5**	**0.7**	**0.9**	**1.1**	**1.1**	**1.3**	**1.4**	**1.6**	**1.7**	**1.9**
Average	**9.1**	**10.3**	**11.3**	**11.8**	**12.2**	**12.2**	**12.5**	**12.5**	**12.5**	**12.3**	**12.0**	**11.7**	**11.4**	**11.0**

Source: own processing

The costs associated with the sub-stream Other Municipal Waste will reach their maximum in the period 2028–2030. After this period, costs will decrease as a result of the reduction in the quantity of this waste (the effect of the growth of separate collection of waste within the sub-stream Separately Collected Waste).
Furthermore, the growth of costs associated with this sub-stream is expected only in the period 2025–2028, by approx. CZK 0.8 billion. In the following period and after 2030, a decrease in costs associated with the sub-stream Other Waste is expected, by CZK 1.9 billion by 2035.

The development for all three aggregated sub-streams of municipal waste is shown in the following graph (Graph 28).

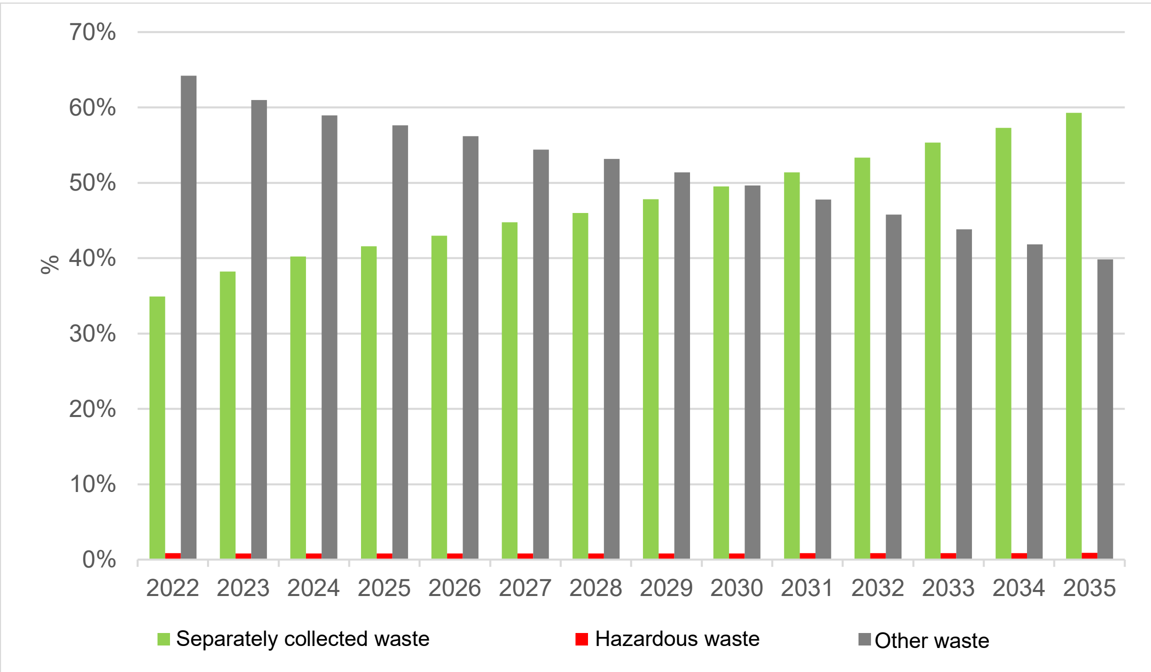
Graph 28: Projected Development of the Total Average Costs of Municipalities Associated with Individual Sub-streams of Municipal Waste (CZK billion)



Source: own processing

The share of individual sub-streams in the total municipal waste management costs of municipalities and the development of their share in total municipal waste management costs by 2035 are illustrated in the following graph (*Graph 29*).

Graph 29: Percentage Share of Municipal Costs Associated with Individual Sub-streams of Municipal Waste in the Total Costs of Municipal Waste in Individual Years (%)



Source: own processing

From 2025 to 2030, the share of costs associated with the sub-stream Separately Collected Waste will increase by 8 percentage points, and between 2030–2035 this share will increase by a further 10 percentage points. Proportionately, the share of costs of the sub-stream Other Municipal Waste in the total costs of municipal waste of municipalities will decrease. The share of the sub-stream Hazardous Municipal Waste practically does not change over time.

5.1.1.4 Share of EPR in the Costs of Municipalities

The analysis in this chapter is based on the assumption of the introduction of the defined new EPR systems set out in the assumptions of the analysis from 2027, with their gradual development. The following table shows the development of municipal revenues from EPR systems in the years 2022–2035. The table does not present all six scenarios, but only the scenario with the lowest and highest revenues and the average value. The table also contains the differences between the scenarios with the highest and lowest costs.

Table48: *Projected Development of Municipal Revenues from EPR Systems in the Years 2022–2035 (CZK billion)*

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Minimum	2.4	3.0	3.5	3.8	4.0	6.0	6.3	6.7	7.0	7.3	7.6	7.9	8.2	8.5
Maximum	2.4	3.0	3.5	3.8	4.1	6.2	6.5	6.9	7.3	7.7	8.0	8.3	8.7	9.0
Difference max-min	**0.0**	**0.0**	**0.0**	**0.1**	**0.1**	**0.2**	**0.2**	**0.2**	**0.3**	**0.3**	**0.4**	**0.4**	**0.5**	**0.5**
Average	**2.4**	**3.0**	**3.5**	**3.8**	**4.1**	**6.1**	**6.4**	**6.8**	**7.2**	**7.5**	**7.8**	**8.1**	**8.4**	**8.8**

Source: own processing

The largest projected share of municipal revenues from EPR will be covered through EPR for packaging and packaging waste. According to the individual scenarios, this market segment should account for around 72 % of municipal revenues from EPR systems in 2030–2035.

The following table shows the recalculation of the projected municipal costs for municipal waste after deducting municipal revenues from EPR systems. The table does not present all six scenarios, but only the scenario with the lowest and highest costs and the average value. The table also contains the differences between the scenarios with the highest and lowest costs.

Table49: *Summary of Scenarios – Municipal Costs for Municipal Waste Management after Deduction of Municipal Revenues from EPR Systems (CZK billion)*

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Minimum	11.8	13.9	15.6	16.6	17.4	16.1	16.7	17.0	17.5	17.7	17.8	18.0	18.1	18.2
Maximum	11.8	14.0	15.8	16.8	17.8	16.7	17.5	17.9	18.5	18.8	19.0	19.3	19.5	19.8
Difference max-min	**0.0**	**0.1**	**0.1**	**0.2**	**0.4**	**0.6**	**0.8**	**0.9**	**1.0**	**1.1**	**1.2**	**1.3**	**1.4**	**1.6**
Average	**11.8**	**14.0**	**15.7**	**16.7**	**17.6**	**16.4**	**17.1**	**17.5**	**17.9**	**18.2**	**18.4**	**18.6**	**18.8**	**18.9**

Source: own processing

According to the analysis carried out and the evaluation of individual scenarios of generation and management of municipal waste streams of municipalities, in relation to the assumption of co-financing of individual waste streams by the relevant EPR systems, it can be expected that the net costs of municipalities for municipal waste after deduction of revenues from EPR will amount to CZK 16.7 billion in 2025, CZK 17.9 billion in 2030, and CZK 18.9 billion in 2035.

The following table shows the recalculation of the projected municipal costs for municipal waste after deduction of municipal revenues from EPR systems, per capita. The table does not present all six scenarios, but only the scenario with the lowest and highest costs and the average value. The table also contains the differences between the scenarios with the highest and lowest costs.

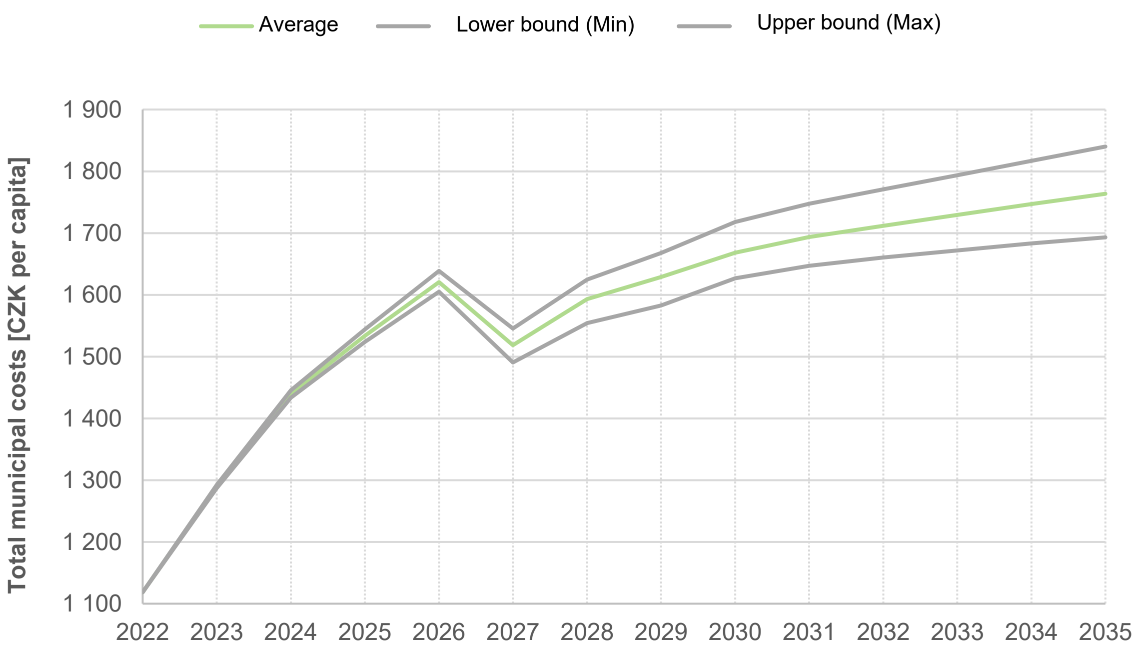
Table*50: Summary of Scenarios – Municipal Costs for Municipal Waste Management after Deduction of Revenues from EPR Systems (CZK per capita)*

	2022	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Minimum	1,119	1,287	1,434	1,524	1,605	1,491	1,554	1,583	1,627	1,647	1,660	1,672	1,683	1,693
Maximum	1,119	1,292	1,446	1,544	1,639	1,545	1,625	1,668	1,718	1,748	1,771	1,794	1,817	1,840
Difference max-min	**0**	**5**	**12**	**20**	**33**	**55**	**71**	**85**	**91**	**101**	**111**	**122**	**134**	**147**
Average	**1,119**	**1,289**	**1,440**	**1,534**	**1,621**	**1,519**	**1,593**	**1,629**	**1,668**	**1,693**	**1,712**	**1,730**	**1,747**	**1,764**

Source: own processing

From the citizen's perspective, these will be the net costs (costs of municipal waste after deduction of revenues from EPR systems), which should be passed on to them. In the period 2022–2030, an increase of approx. CZK 550 per capita is expected. In the following period, the growth of costs per capita should be more gradual. In the period 2030–2035, an increase of a further just under CZK 100 per capita can be expected.

Graph 30: Scenarios for the development of total municipal costs of municipal waste management after deduction of revenues from EPR schemes by 2035 (CZK per capita)



Source: own processing

The graph shows that a significant change of trend will be achieved in the period of the introduction of new EPR systems and the start of financial participation in the financing of municipal systems ensuring the collection and management of the relevant products under the take-back regime.

5.1.2 Outputs of Individual Scenarios of Generation and Management – Other Waste Holders

5.1.2.1 Total Costs of Other Waste Holders for Municipal Waste

In the following table (Table 51) presents the aggregated data of the scenarios so that the range of calculated values is clear and the expected trend of the development of the total costs of other waste holders for municipal waste can be determined. The table does not present all six scenarios, but only the scenario with the lowest and highest costs and the average value. The table also contains the differences between the scenarios with the highest and lowest costs.

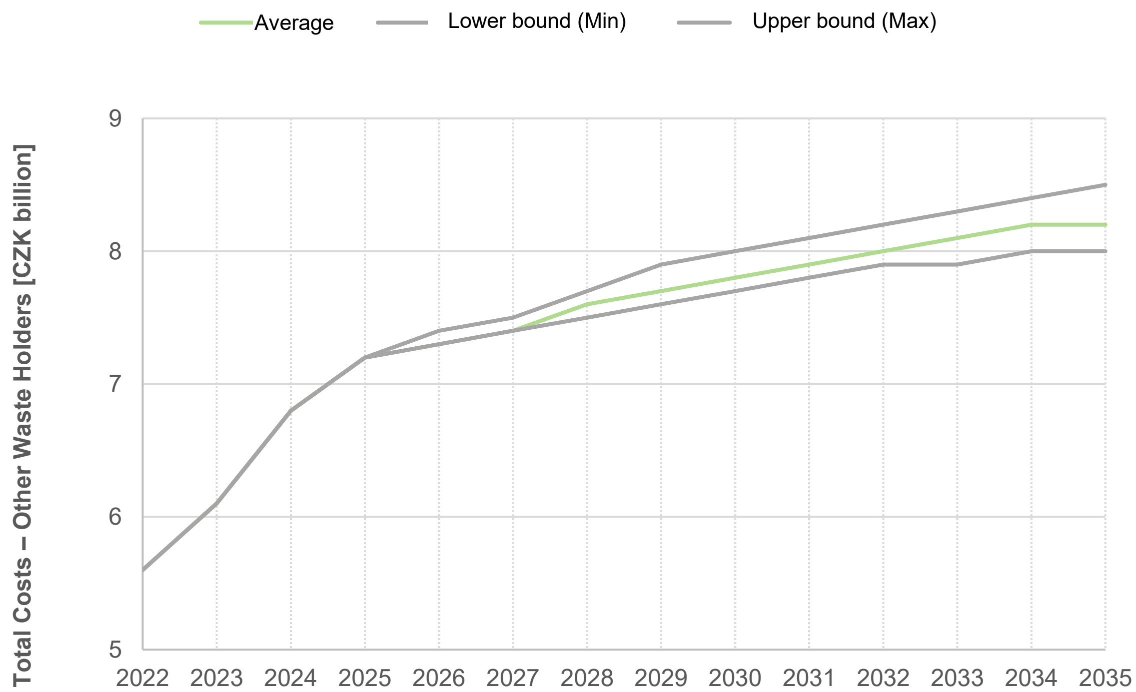
Table 51: Summary of Scenarios for the Total Costs of Other Waste Holders for Municipal Waste (CZK billion)

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Minimum	5.6	6.1	6.8	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	7.9	8.0	8.0
Maximum	5.6	6.1	6.8	7.2	7.4	7.5	7.7	7.9	8.0	8.1	8.2	8.3	8.4	8.5
Difference max-min	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4
Average	5.6	6.1	6.8	7.2	7.3	7.4	7.6	7.7	7.8	7.9	8.0	8.1	8.2	8.2

Source: own processing

The following graph shows the costs from 2022 and the projected development of these costs by 2035. These are the costs of other waste holders for the management of municipal waste. In this graph, only two scenarios and the average value of all six scenarios are shown.. The limit scenarios are T1N3 with the lowest costs and T2N1 with the highest costs

Graph 31: Scenarios of the Development of the Total Costs of Other Waste Holders for Municipal Waste up to 2035 (CZK billion)



Source: own processing

Total municipal waste management costs of other waste holders increase significantly by 2025, followed by a more gradual rise through to 2035. The total increase between 2022–2035 is, according to the average value, CZK 2.6 billion.

5.1.2.2 Costs Broken Down by Sub-streams of Municipal Waste – Other Waste Holders

This chapter presents the aggregated costs of defined sub-streams of municipal waste for other waste holders of municipal waste.
For clarity, the aggregation of waste into three main sub-streams is presented in relation to the subsequent method of management. The inclusion of waste in the individual sub-streams is shown in the following table.

Table52: *Aggregation of Municipal Waste into Sub-streams According to the Predominant Method of Management*

Waste	Dominant Method of Management	Name of Sub-stream
Paper	Treatment and Recycling	Separately Collected Waste
Plastics	Treatment and Recycling	Separately Collected Waste
Glass	Treatment and Recycling	Separately Collected Waste
Metal	Treatment and Recycling	Separately Collected Waste
Textiles	Treatment and Recycling	Separately Collected Waste
Biowaste from Gardens and Parks	Treatment and Recycling	Separately Collected Waste
Biowaste from Kitchens and Canteens – Catering Waste	Treatment and Recycling	Separately Collected Waste
Edible Oils	Treatment and Recycling	Separately Collected Waste
Wood	Treatment and Recycling	Separately Collected Waste
Hazardous Waste	Disposal	Hazardous Waste
Waste from Marketplaces	Energy Recovery/Disposal	Other Waste
Street Sweepings	Energy Recovery/Disposal	Other Waste
Bulky Waste	Energy Recovery/Sorting/Disposal	Other Waste
Mixed Municipal Waste	Energy Recovery/Sorting/Disposal	Other Waste
Other Municipal Waste Not Listed Above	Energy Recovery/Disposal	Other Waste

Source: own processing

The following table shows the increase in costs for waste included in the sub-stream Separately Collected Waste. The table does not present all six scenarios, but only the scenario with the lowest and highest costs. In general, scenarios T1 have higher costs than scenarios T2. Furthermore, the table shows the average value. The table also contains the differences between the scenarios with the highest and lowest costs.

Table53: *Summary of Scenarios of Costs of Other Waste Holders for Municipal Waste Management within the Sub-stream Separately Collected Waste (CZK billion)*

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Minimum	1.4	1.7	2.0	2.1	2.3	2.5	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0
Maximum	1.4	1.7	2.0	2.2	2.4	2.5	2.7	2.9	3.1	3.3	3.5	3.8	4.0	4.3

Difference max-min	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2
Average	1.4	1.7	2.0	2.2	2.3	2.5	2.7	2.9	3.0	3.2	3.5	3.7	3.9	4.1

Source: own processing

A fundamental driver of the growth of costs associated with the sub-stream Separately Collected Waste is the projected increase in the amount of sorted separately collected waste, and the costs thereby incurred in ensuring their collection, transport, and transfer for subsequent management. According to the analysis, the growth of these costs reaches CZK 0.8 billion in the period 2025–2030, and in the period 2030–2035 this growth represents a further CZK 0.9 billion.

Overall, the costs of other waste holders for the management of the sub-stream Separately Collected Waste will increase by CZK 1.7 billion between 2025 and 2035.

The following table presents a summary of scenarios of costs for items included in the sub-stream Hazardous Waste. The total costs are negligible in all scenarios.

Table*54*: *Summary of Scenarios of Costs of Other Waste Holders for Municipal Waste Management within the Sub-stream Hazardous Waste (CZK billion)*

Scenario	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
T1N1-T2N3	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03

Source: own processing

The costs of other waste holders associated with the sub-stream Hazardous Waste are negligible compared to the other sub-streams of municipal waste. In the long term, they will stagnate.

The following table shows the increase in costs of other waste holders for waste classified under the sub-stream Other Waste. The table does not present all six scenarios, but only the scenario with the lowest and highest costs. This refers to scenario T1N3 with the lowest costs and scenario T2N1 with the highest costs, as well as the average value. The table also contains the differences between the scenarios with the highest and lowest costs.

Table*55*: *Summary of Scenarios of Costs of Other Waste Holders for Municipal Waste Management within the Sub-stream Other Waste (CZK billion)*

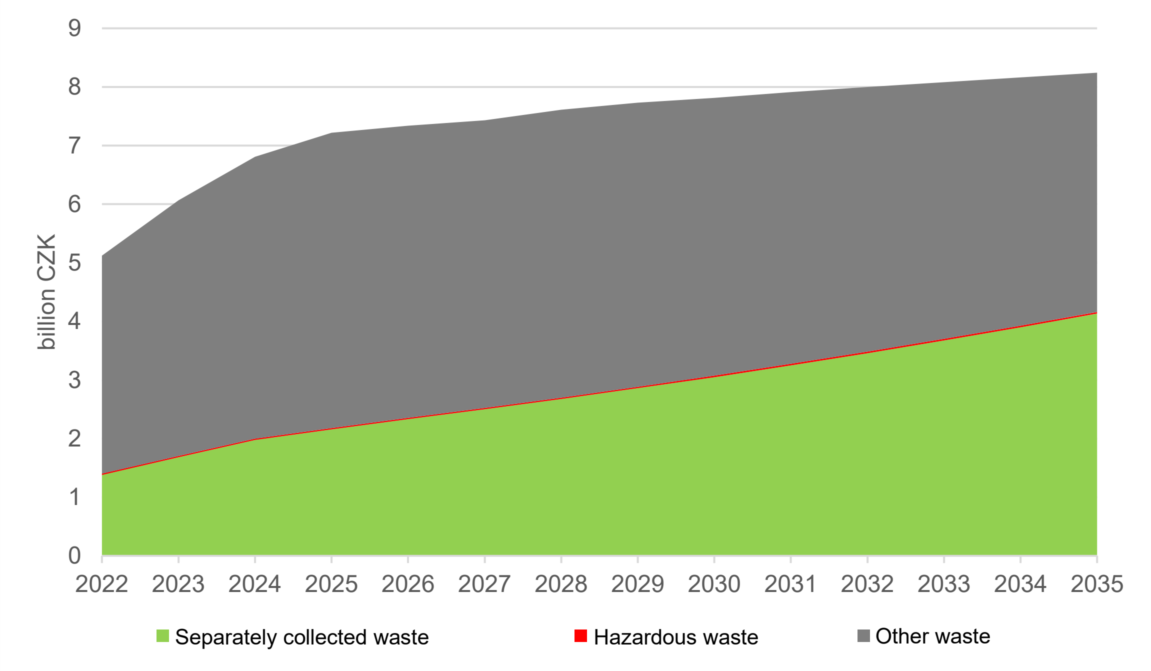
	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Minimum	3.7	4.4	4.8	5.0	4.9	4.8	4.8	4.7	4.6	4.4	4.3	4.1	3.9	3.8
Maximum	3.7	4.4	4.8	5.1	5.1	5.0	5.1	5.0	5.0	4.9	4.8	4.7	4.5	4.4
Difference max-min	0.0	0.0	0.1	0.1	0.2	0.2	0.3	0.4	0.4	0.4	0.5	0.5	0.6	0.7
Average	3.7	4.4	4.8	5.0	5.0	4.9	4.9	4.8	4.7	4.6	4.5	4.4	4.2	4.1

Source: own processing

The costs associated with the sub-flow Other Waste originating from other waste holders will reach their peak in the period 2025–2026. After this period, costs related to this sub-flow will decrease due to the decline in the quantity of waste included in the Other Waste sub-flow. According to the analysis, growth in costs for the Other Waste sub-flow from other waste holders is expected only in the period 2022–2026, by approximately CZK 1.3 billion. In the following period and after 2030, a decrease in costs connected with this sub-flow is expected, by CZK 0.9 billion by 2035.

The development of costs for all three aggregated sub-flows is shown in the following graph.

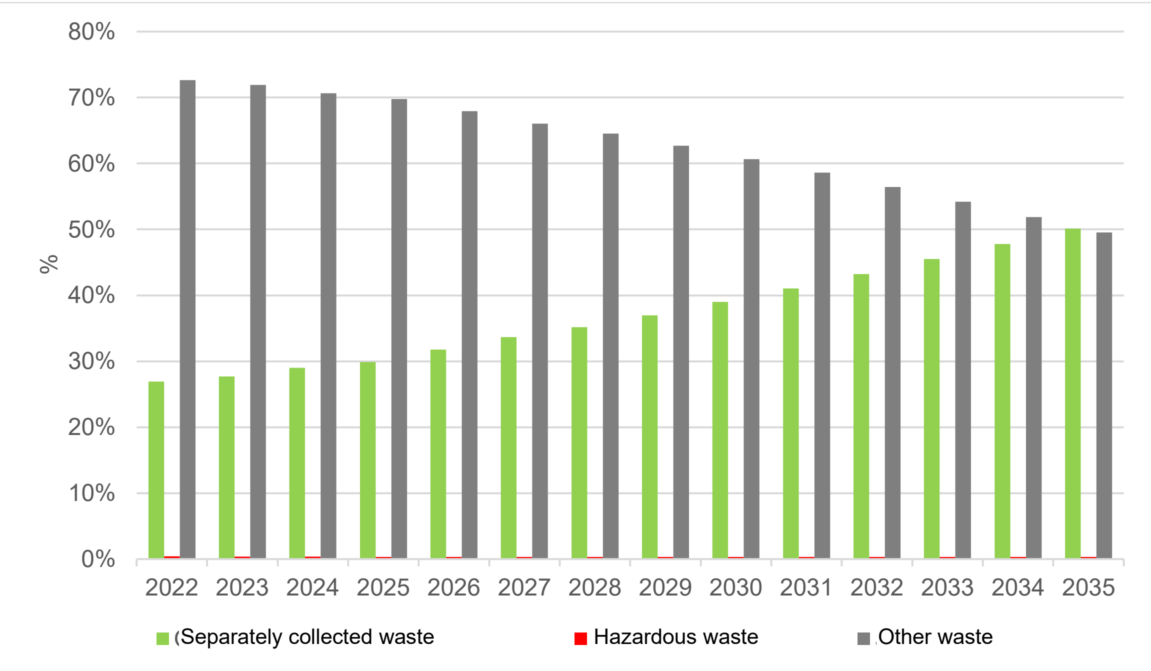
Graph 32: Projected Development of the Average Costs of Other Waste Holders Related to the Individual Sub-Flows of Municipal Waste (CZK billion)



Source: own processing

The development of the share of costs associated with the individual sub-streams defined in Table No. 50 in the total municipal waste management costs of other waste holders by 2035 is illustrated in the following graph.

Graph 33: Percentage Share of Costs Associated with the Individual Sub-Flows of Municipal Waste of Other Waste Holders in the Total Costs of Municipal Waste of Other Waste Holders in Individual Years (%)



Source: own processing

Between 2025 and 2035, the share of costs of municipal waste of other waste holders associated with the Separately Collected Waste sub-flow will increase by 20 percentage points.
Correspondingly, the share of costs of the Other Waste sub-flow of other waste holders in the total municipal waste costs of other waste holders will decrease.
The share of the Hazardous Waste sub-flow from the municipal waste of other waste holders will remain practically unchanged over time.
In comparison with the development of the cost shares of the individual municipal waste sub-flows of municipalities in the total municipal waste costs of municipalities, a significantly lower growth in the share of costs associated with the Separately Collected Waste sub-flow of other waste holders in the total costs of other waste holders for municipal waste is evident.

5.1.3 Outputs of the individual scenarios of generation and management of municipal waste – total costs

This chapter presents the outputs of the prepared analysis of the projected development of municipal waste costs for all municipal waste holders.

5.1.3.1 Total Municipal Waste Costs

In the following table (Table 56) presents aggregated data of the cost scenarios for municipal waste of municipalities and other waste holders, in order to show the spread of calculated values and to determine the expected trend of total costs. The table does not present all six scenarios, but only the scenario with the lowest and highest costs. These are the T1N3 scenario with the lowest costs and the T2N1 scenario with the highest costs. In addition, the table shows the average value. The table also contains the differences between the scenarios with the highest and lowest costs.

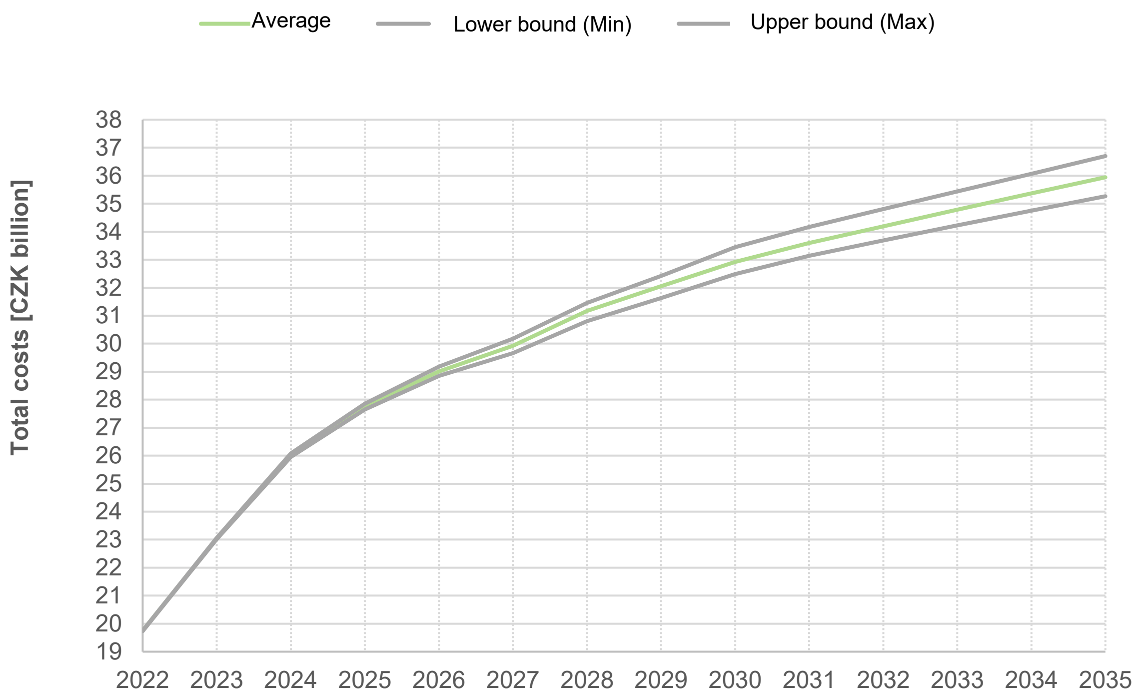
Table 56: Summary of Scenarios for the Total Costs of Municipal Waste (CZK billion)

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Minimum	19.7	23.0	26.0	27.6	28.9	29.7	30.8	31.6	32.5	33.1	33.7	34.2	34.7	35.3
Maximum	19.8	23.1	26.1	27.9	29.2	30.2	31.5	32.4	33.5	34.2	34.8	35.4	36.1	36.7
Difference max-min	0.0	0.1	0.1	0.2	0.3	0.5	0.7	0.8	1.0	1.0	1.1	1.2	1.3	1.4
Average	19.7	23.0	26.0	27.8	29.0	29.9	31.2	32.1	32.9	33.6	34.2	34.8	35.4	35.9

Source: own processing

The graph below illustrates the described findings. This graph shows only two scenarios and the average value. The boundary scenarios are scenario T1N3 with the lowest costs and scenario T2N1 with the highest costs.

Graph 34: Scenarios for the development of total municipal waste management costs by 2035 (CZK billion)



Source: own processing

Total municipal waste management costs increase significantly by 2024, after which the growth curve flattens, and a more gradual increase continues through to 2035. The total increase between 2022–2035 is, according to the average value, CZK 16 billion.

5.1.3.2 Costs by Main Sub-streams of Municipal Waste – Total

This chapter presents aggregated costs of the defined sub-streams of municipal waste for all municipal waste holders.

For clarity, the aggregation of waste into three main sub-streams is presented in relation to the subsequent method of management. The inclusion of waste in the individual sub-streams is shown in the following table.

Table57: *Aggregation of Municipal Waste into Sub-streams According to the Predominant Method of Management*

Waste	Dominant Method of Management	Name of Sub-stream
Paper	Treatment and Recycling	Separately Collected Waste
Plastics	Treatment and Recycling	Separately Collected Waste
Glass	Treatment and Recycling	Separately Collected Waste
Metal	Treatment and Recycling	Separately Collected Waste
Textiles	Treatment and Recycling	Separately Collected Waste
Biowaste from Gardens and Parks	Treatment and Recycling	Separately Collected Waste
Biowaste from Kitchens and Canteens – Catering Waste	Treatment and Recycling	Separately Collected Waste

Waste	Dominant Method of Management	Name of Sub-stream
Edible Oils	Treatment and Recycling	Separately Collected Waste
Wood	Treatment and Recycling	Separately Collected Waste
Hazardous Waste	Disposal	Hazardous Waste
Waste from Marketplaces	Energy Recovery/Disposal	Other Waste
Street Sweepings	Energy Recovery/Disposal	Other Waste
Bulky Waste	Energy Recovery/Sorting/Disposal	Other Waste
Mixed Municipal Waste	Energy Recovery/Sorting/Disposal	Other Waste
Other Municipal Waste Not Listed Above	Energy Recovery/Disposal	Other Waste

Source: own processing

The following table shows the increase in costs for items included in the sub-stream Separately Collected Waste. The table does not present all six scenarios, but only the scenario with the lowest and highest costs. It holds true that scenarios T1 show higher costs than scenarios T2. The table also shows the average value. The table also contains the differences between the scenarios with the highest and lowest costs.

Table58: *Summary of Scenarios of Costs for Municipal Waste Management within the Sub-stream of Separately Collected Waste (CZK billion)*

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Minimum	6.3	8.1	9.6	10.6	11.5	12.4	13.3	14.2	15.2	16.1	17.0	18.0	19.0	20.0
Maximum	6.3	8.2	9.8	10.8	11.8	12.7	13.7	14.7	15.8	16.8	17.8	18.9	20.0	21.1
Difference max-min	0.0	0.1	0.1	0.2	0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1
Average	6.3	8.2	9.7	10.7	11.6	12.6	13.5	14.5	15.5	16.4	17.4	18.4	19.5	20.6

Source: own processing

The main factor influencing the growth of costs associated with the sub-stream of separately collected components is the expected increase in the sorted quantity of separately collected waste, and the resulting costs of ensuring its collection, transport, and transfer for subsequent treatment. The growth of these costs amounts to CZK 4.8 billion in the period 2025–2030, and in the period 2030–2035 represents a further CZK 5.2 billion.

In total, the costs of all municipal waste holders for managing the sub-stream of separately collected municipal waste are expected, according to the analysis, to rise by CZK 10 billion between 2025 and 2035.

The following table shows the total costs for waste classified under the sub-stream of hazardous municipal waste. The total costs associated with this sub-stream of municipal waste are negligible in all scenarios.

Table59: *Summary of scenarios for total costs of managing municipal waste in the sub-stream of hazardous waste (CZK billion)*

Scenario	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
T1N1-T2N3	0.16	0.16	0.18	0.19	0.20	0.21	0.22	0.22	0.23	0.24	0.25	0.26	0.27	0.27

Source: own processing

Total costs of all municipal waste holders associated with the sub-stream of hazardous waste are negligible compared to other municipal waste sub-streams.
In the long term, they will show only a slight increase.

The following table shows the increase in total costs for waste classified under the sub-stream of other waste. The table does not include all six scenarios, but only the scenario with the lowest and the highest total costs of this sub-stream. These are scenario T1N3 with the lowest costs of this sub-stream and scenario T2N1 with the highest costs of this sub-stream. Furthermore, the table shows the average value. The table also contains the differences between the scenarios with the highest and lowest costs associated with this sub-stream.

Table*60*: *Summary of scenarios for total costs of managing municipal waste in the sub-stream of other waste (CZK billion)*

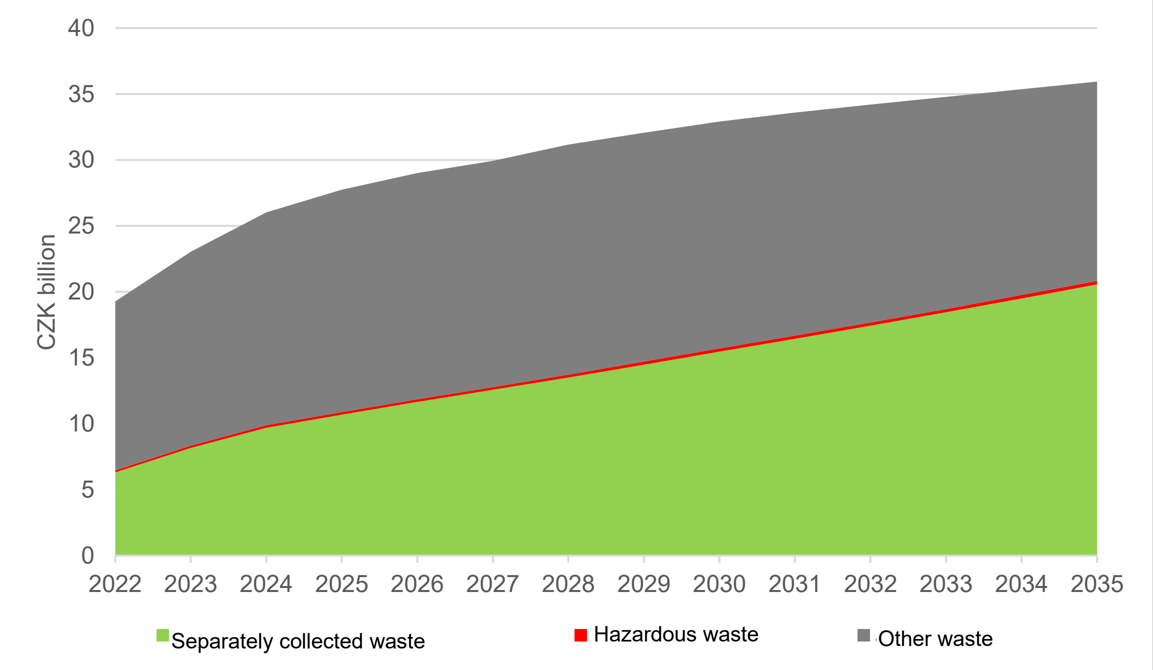
	2022	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Minimum	12.8	14.7	16.0	16.7	16.9	16.7	16.9	16.7	16.5	16.1	15.6	15.1	14.5	13.9
Maximum	12.8	14.8	16.3	17.1	17.5	17.6	17.9	18.0	18.0	17.8	17.5	17.2	16.8	16.4
Difference max-min	0.0	0.1	0.2	0.4	0.6	0.8	1.1	1.3	1.5	1.7	1.9	2.1	2.3	2.5
Average	12.8	14.7	16.1	16.9	17.2	17.1	17.4	17.3	17.2	16.9	16.5	16.1	15.6	15.1

Source: own processing

The total costs of all municipal waste holders associated with this sub-stream will peak in 2028. After this period, the total costs of this sub-stream will decrease due to the decline in the volume of waste classified under other waste (the effect of increasing amounts of separately collected waste within the sub-stream of separately collected fractions).
According to the analysis, total municipal waste costs linked to the sub-stream of other waste are expected to rise only in the period 2022–2028, by approximately CZK 4.6 billion. In the following period and after 2030, a decrease in costs connected with this sub-flow is expected, by CZK 2.3 billion by 2035.

The development of total costs associated with municipal waste for all three aggregated sub-streams is shown in the following graph.

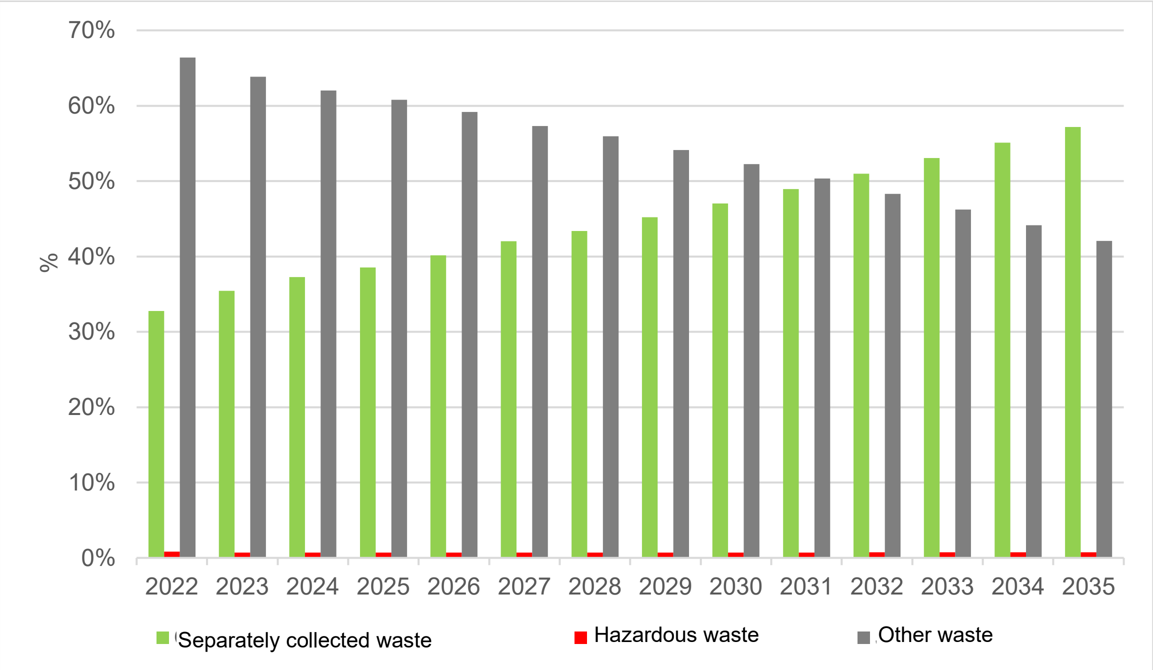
Graph 35: Projected development of average costs associated with individual sub-streams of municipal waste (CZK billion).



Source: own processing

The development of the share of individual municipal waste sub-streams in the total costs of municipal waste management until 2035 is illustrated in the following graph.

Graph 36: Percentage share of total costs associated with individual municipal waste sub-streams in the total costs of municipal waste management in individual years (%)



Source: own processing

From 2025 to 2035, the share of total costs of all municipal waste holders associated with the sub-stream of separately collected waste will increase by 28 percentage points. Correspondingly, the share of total costs of the other waste sub-stream in the total costs of municipal waste management will decrease. The share of costs of the hazardous waste sub-stream will remain virtually unchanged over time.

5.2 Identification of Required Investments

From the perspective of predicting investments, it is possible to make a qualified estimate of the needs for individual defined waste streams where the waste holders are municipalities and other producers. This need is generally determined by the level of investment in the given segment, relative to the predicted development of the waste stream and politically set targets.

Therefore, in predicting the required investments for achieving the objectives of the Waste Management Plan of the Czech Republic, the calculation is based on the missing capacities at the level of collection (municipal waste from municipal systems) and subsequent treatment of selected significant waste streams (municipalities and other producers). The missing capacities are the difference between the current capacity of facilities for handling given waste streams and their predicted production and expected treatment in a specific type of facility in key years 2025, 2030, 2035, and 2040.

Note: The estimates of investment costs (unit costs) are based on an expert market and literature review from 2023 and may differ in reality depending on the development of the economic environment.

5.2.1 Investment Costs Related to the Expansion of the Collection Network – Municipal Waste of Municipalities

These costs are derived from the forecast of the development of production and collection of waste volumes in order to ensure the fulfilment of the objectives of the Waste Management Plan of the Czech Republic. This forecast can primarily be made for municipal waste originating from municipal systems.

From the perspective of developing efficient waste collection systems, this primarily involves the expansion of the collection network for the separate collection of recyclable waste, as well as the expansion and additional equipment of collection yards in order to ensure the separate collection of other fractions of municipal waste at the municipal level. The collection of each commodity depends on the collection and transport system set by each municipality or waste collection company.

The law obliges municipalities to establish collection points for the separate collection of certain fractions of municipal waste. These are hazardous waste, paper, plastics, glass, metals, biowaste, edible oils and fats, and textiles. The development of separate collection is fully within the competence of each municipality. It is therefore not possible to precisely define the types and quantities for the expansion of the collection network of individual commodities of sorted waste in the Czech Republic.

The goal of developing the collection network for separately collected fractions of municipal waste is its optimisation and ensuring effective accessibility for citizens and entities involved in municipal systems so that it is accepted by its users and fully utilised. The aim of the collection network is to generate a sufficient quantity of quality raw material for entry into technologies for subsequent treatment and processing of waste with the aim of its recycling and recovery.

For the purpose of determining the level of investments in the collection network, the following assumptions were adopted:

- For commodities that can be collected through door-to-door systems, the assumption was made of their expansion into detached housing across the entire Czech Republic. In these areas, the objective should then be to optimise the number and capacity of containers placed in public spaces.

Any surplus containers withdrawn from public spaces in municipalities with a door-to-door system will be used to supplement the collection network in apartment building areas within the given municipality or in other municipalities.

- For biowaste, investments were calculated for a combination of containers within the door-to-door system and the gradual development of kitchen waste collection also in apartment building areas.
- The collection of biodegradable waste from kitchens and canteens also included catering facilities in the calculation.
- Investments in containers for other separately collected commodities were calculated on the basis of an assessment of indicative investment needs for the collection network, and projections were made of the need to upgrade the collection network for each separately collected commodity.

The projections were based on the forecast of the development of the quantities of separately collected commodities and the resulting need to increase the volume of collected waste in the respective waste streams, taking into account the average collection frequency of the given waste stream.

Based on available market data on average prices of collection bins and containers, the average price per 1m³ of container was calculated.

The following table shows indicative price ranges per installed m³ of container.

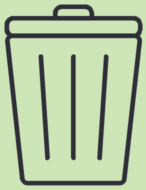
Table61: *Indicative Prices for the Procurement of Collection Containers (CZK thousand/m³)*

Types of containers	**Indicative Prices (CZK**	**Comment**
Standard primarily plastic containers colour-coded for specific commodities	4–6	
Special fibreglass containers	8–15	
Containers with specific properties, such as water impermeability, protection against unauthorised access, or containers with sealed lids for the collection of kitchen waste and catering waste	6–20	Investments are highly dependent on volume, technical design, and specific requirements for the supply of collection facilities
Large-capacity containers with a capacity of 10–40 m³	3–4	
Compactor containers with a capacity of 15–30 m³	12–16	

Source: own processing, market price survey

The highest prices are reached by special containers (up to CZK 20 thous./m³). Prices increase with the quality and durability of the material from which they are made. Investments in the collection network are very difficult to predict due to the varying frequency of use and, therefore, the lifespan of the containers purchased. The service life of containers ranges from 4–6 years for HDPE (high-density polyethylene) [7] containers to 15–20 years for fibreglass or metal containers.

In view of the deficit in collection network capacity and the indicative procurement prices per m³ of container, the expected total indicative investment requirement for upgrading the collection network has been calculated.



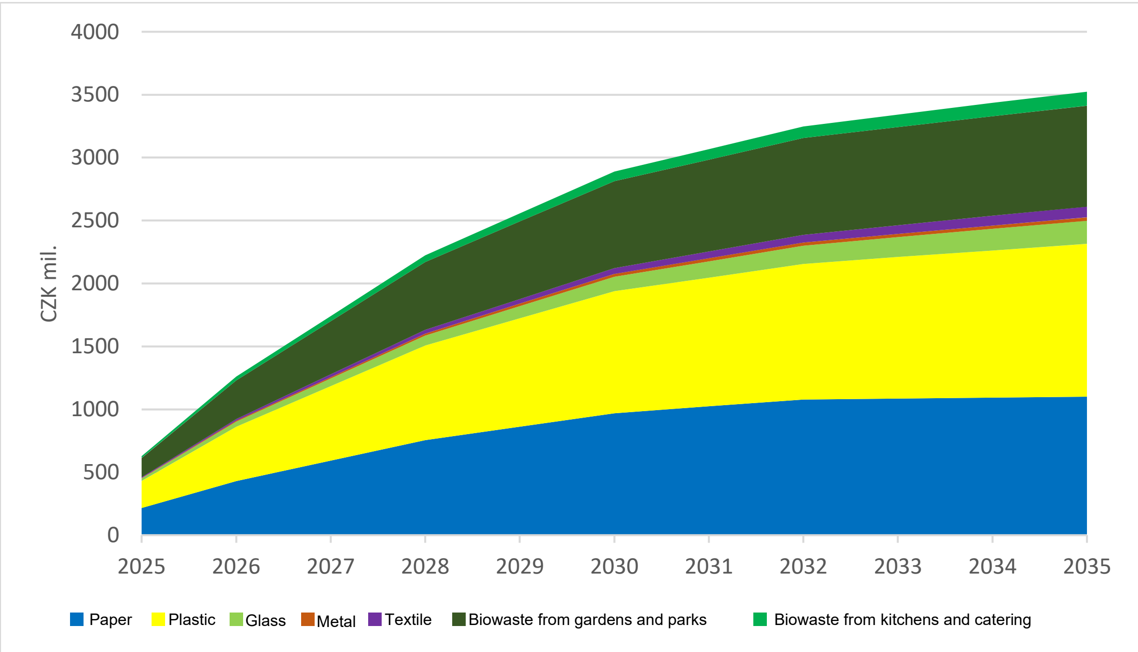
For the purposes of the WMP of the Czech Republic, only investments in the expansion of the collection network were considered, not for its replacement. The missing capacity of the collection network is multiplied by the average price per m³ of container.

1.1.1.1 Container Collection

Based on the assumed development of production of individual separately collected commodities within the defined waste production scenarios T1 and T2 in the municipal system, data on the number of family houses, and the assumption of coverage of family houses by door-to-door collection as well as the number of catering facilities, the expected development of investment costs associated with the acquisition of containers for the expansion of collection of the respective commodities was subsequently calculated, primarily within the municipal separate collection system.

The following tables present the expected investments for the production scenario (Graph 37) and production scenario T2 (Graph 38).

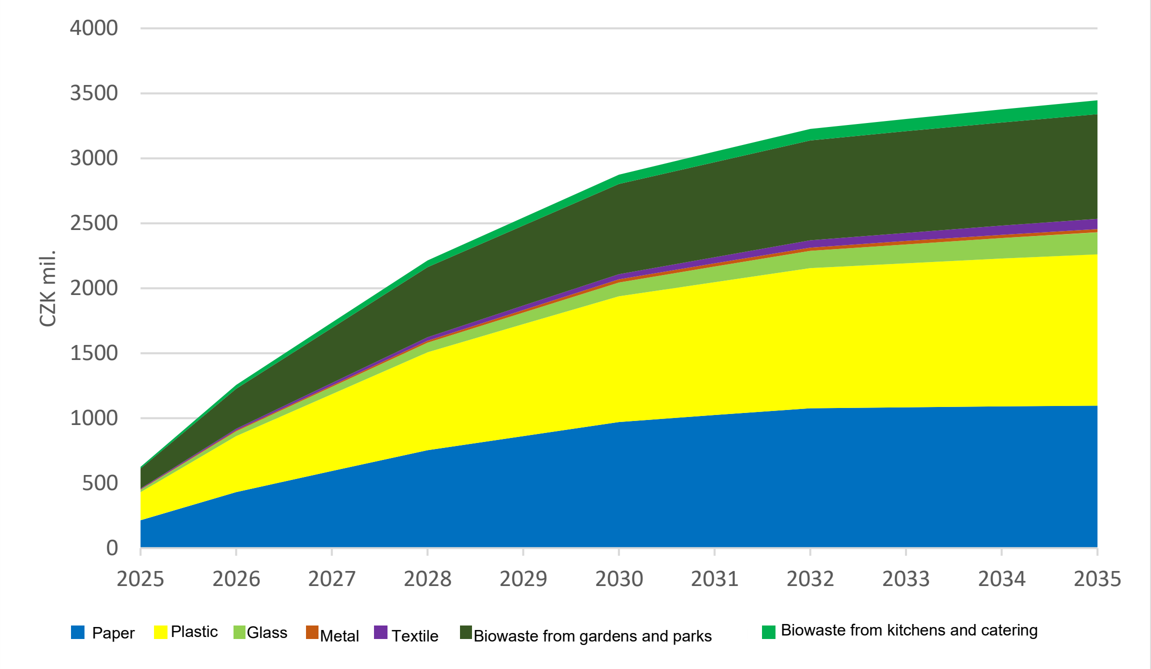
Graph 37: Expected Investments into the Development of the Municipal Collection Network – Production Scenario T1 (mil. CZK)



Source: own processing

[7] High Density Polyethylene – Polyethylene with High Density.

Graph 38: Expected Investments into the Development of the Municipal Collection Network – Production Scenario T2 (mil. CZK)



Source: own processing

The highest investment costs for the development of the collection network are associated with commodities for which intensive implementation of the door-to-door system is expected. These include paper, plastic, and biowaste as a whole. Investments into containers for collecting these commodities account for almost 90% of the total expected costs.

Under production scenario T1, approximately CZK 3.5 billion should be invested into the development of the collection network by the end of 2035.

Under production scenario T2, approximately CZK 3.4 billion should be invested into the development of the collection network by the end of 2035.

In both cases, it is evident that investments into the development of the collection network should exceed CZK 3.4 billion by 2035. The long-term assumption for the years 2035–2040 is then zero, since the development of the collection network should be saturated by these investments, and it will primarily involve its maintenance and reconstruction.

Table62: *Assumed Amount of Investment Expenditure for the Development of Container Collection between 2025 and 2035, Scenarios T1 and T2 (CZK billion)*

Production Scenario	Period by 2030	Period 2030–2035	Total by 2035
T1	2.6	0.9	**3.5**
T2	2.5	0.9	**3.4**

Source: own processing, market price survey

In the outlook for the years 2035–2040, activities will consist primarily of the reconstruction of equipment and its replenishment. In the event of technological or legislative changes in the preceding period, the estimates of required investments may change significantly.

The highest investment costs for container collection of separately recoverable waste, predominantly within municipal systems, are associated with commodities for which the intensive introduction of the door-to-door system is envisaged. These are therefore primarily the commodities paper, plastic, and biodegradable waste (BDW) from both gardens and kitchens and catering facilities. Investments in containers for the development of the collection of these commodities represent almost 90% of the total estimated costs of investments in the development of the collection network.

Collection Yards

For ensuring the efficient collection, particularly of bulky waste and products within the framework of take-back schemes, it is absolutely essential that the Czech Republic possesses a high-quality network of collection yards and collection points. In 2022, more than 1,300 municipalities, representing 7 million inhabitants of the Czech Republic, were covered by collection yards. Municipalities that recorded collection through a collection yard or collection point covered almost 8 million inhabitants in 2022. The exact number of collection yards or collection points is not recorded anywhere. The data presented are based on documents provided by the authorised packaging company. A large number of collection yards are also constructed thanks to subsidy support from the Operational Programme Environment.

According to the analysis, most municipalities already enable citizens to hand over waste at a collection yard, collection point, or make use of mobile waste collections for waste not collected within the container or bag collection network.

For the purpose of estimating investment costs for the development of collection yards, a qualified estimate of the need for new collection yards by 2035 was set at 150 to 200 new collection yards. The number of collection yards is not influenced by waste generation scenarios T1 and T2, as this concerns the need for comprehensive coverage of the territory and ensuring accessibility for citizens. The investment is based on the assumption of average costs for the construction of an average collection yard of CZK 20 million. The assumption of total investments in collection yards is presented in the following table(Table *63*).

Table 63: Amount of investment costs for the development of the collection yard network between 2025 and 2035, scenarios T1 and T2 (CZK billion)

Production Scenario	Period by 2030	Period 2030–2035	Total by 2035
T1, T2	2.5- 3.3	0.5- 0.7	**3- 4**

Source: own processing

The above table (Table 63) shows the estimate of the required investments for the development of the collection yard network in the CR. It follows from this that even in the case of the waste generation scenario T1 as well as the waste generation scenario T2, the expected amount of investments in collection yards ranges between CZK 3–4 billion.

The long-term assumption for the period 2035–2040 no longer envisages further investments, since by 2035 the collection network with collection yards should be sufficiently saturated in terms of these investments. During this period, reconstructions, or replenishment of equipment of collection yards will take place according to current needs.

Total investments in the development of the collection network (container collection and collection yards) for the purpose of its expansion, without investments related to reconstructions, can be assumed in the period 2025 to 2035 at CZK 6.5–7.4 billion.

5.2.2 Investment Costs Related to the Need for Supplementing Technologies

For each waste stream, the capacity needs of the individual types of technologies were assessed. In the case of their insufficiency or technological obsolescence, in connection with the generation of quality raw materials for subsequent recycling and recovery within the circular economy, the differences between the required amount of waste processed in individual years and the current capacities were defined. In this way, the missing capacity of individual types of technologies was determined.

5.2.2.1 Unit Costs of Investments in Technologies

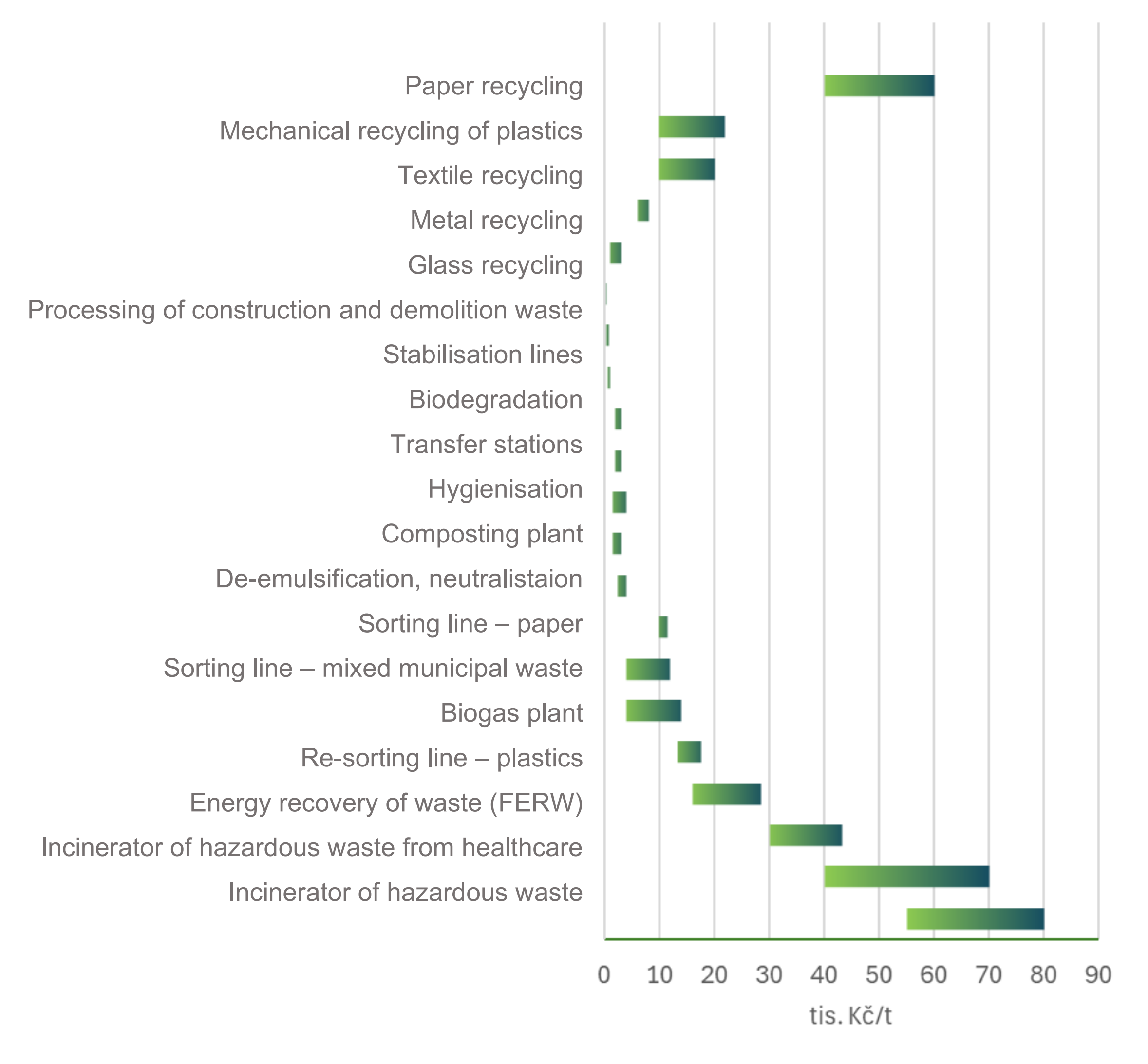
The financial evaluation of investments necessary to ensure sufficient capacity of facilities was based on determining average investments recalculated to the average tonne of annual capacity for each type of technology. This method was chosen due to the differences in costs associated with the construction or acquisition of technology, depending on the facility capacity, construction readiness, equipment, and availability of auxiliary and related technologies, and similar factors. The range of unit costs for the individual groups of technologies is based on the 2023 price levels without taking future inflation into account.

The group of technologies dependent on a large number of variables, such as the type and quality of input waste, requirements for the quality of output, and capacity, are technologies dealing with recycling. For these technologies, the volatility of unit costs is very high.

The prediction of investment costs must therefore be perceived as indicative guidance regarding the financial resources needed to ensure the transition of the current waste management system to a circular economy and the fulfilment of all defined objectives of the WMP CR.

Sources of information on the costs and prices of the individual types of technologies and facilities were obtained from documents and consultations relating to projects in preparation, as well as from information from technology suppliers or technology operators. In cases of data unavailability, consultations with the professional public and expert determination of costs were used. The following graph and table (*Table 64*) present the ranges of unit investment costs related to the individual types of technologies.

Graph 39: Range of unit costs for individual groups of technologies (CZK thousand/t annual capacity)



Source: own processing

In the following table (*Table 64*) specific minimum and maximum investment costs of technologies and facilities for waste management are presented, as well as the mean value of these costs. These represent the most important technologies for waste management in the CR.

Table 64: Estimated investment costs of individual groups of technologies recalculated to the average tonne of annual capacity (CZK thousand/t annual capacity)

Technology	Minimum cost*	Maximum cost*	Mean cost*
Incinerator of hazardous waste	55	80	68.3
Incinerator of hazardous waste from healthcare	40	70	55.0
Energy Recovery of Waste (FERW)	30	43	37.1
Sorting Line – Plastics	16	29	22.3
Biogas Plant	13	18	15.4
Sorting Line for Mixed Municipal Waste	4	14	9.1

Technology	Minimum cost*	Maximum cost*	Mean cost*
Sorting Line – Paper	4	12	9.0
De-emulsification and Neutralisation	10.0	11.5	10.8
Composting Plant	3	4	3.2
Hygienisation	2	3.0	2.3
Transfer Stations	2	4	2.7
Production of Solid Recovered Fuel (SRF)	2	3	2.5
Treatment and Sorting of Bulky Waste	2	3	2.5
Biodegradation	0.5	1	0.7
Stabilisation Lines	0.4	0.7	0.5
Processing of Construction and Demolition Waste	0.2	0.4	0.3
Glass Recycling	1	3	1.5
Metal Recycling	6	8	6.7
Textile Recycling	10	20	15.0
Mechanical Plastics Recycling	10	22	15.0
Paper Recycling:	40	60	45.0

Source: own processing

*These represent the total investment costs of the project, including construction.

Note: The estimates of investment costs (unit costs) are based on an expert market and literature review from 2023 and may differ in reality depending on the development of the economic environment.

The highest investment costs per unit (tonne of annual capacity) are reached by investments in incinerators of hazardous waste, incinerators of healthcare waste, and facilities for energy recovery of waste (FERW), primarily due to the very financially demanding technologies of flue-gas cleaning. The investment costs of these technologies range in the higher tens of thousands of CZK per processed tonne per year.

The second most investment-intensive group in relation to the processed amount of waste consists of paper, plastic, and textile recycling technologies, including waste treatment technologies such as technologically advanced automated sorting/supplementary sorting lines, as well as biogas plant technologies. These technologies range in the lower tens of thousands of CZK per processed tonne per year.

The third most investment-intensive group in relation to the amount of waste processed per year consists of simpler waste treatment technologies, including waste transfer.

The highest costs per tonne of annual capacity of processed waste are incurred by incinerators of hazardous waste (approx. CZK 80 thousand/t), incinerators of hazardous healthcare waste (approx. CZK 70 thousand/t), with relatively high costs also for paper recycling facilities (approx. CZK 60 thousand/t) and facilities for energy recovery of waste (approx. CZK 38 thousand/t).

5.2.2.2 Prediction of the Development of the Need for Investments in Key Technologies from the Perspective of the Future Development of Waste Management

The prediction of the needs for sufficient capacities of facilities for waste management and for technologies ensuring the preferred method of handling individual waste streams is essential for effective planning and sustainable management of waste with the aim of long-term fulfilment of the objectives of the WMP CR.

As already described above, the need for investments is stimulated by the lack of capacities of technologies for preferred methods of handling and processing waste. Some technologies, due to their technical design, are intended only for specific waste streams; on the other hand, there are technologies that are capable of handling waste with similar properties, albeit from different waste streams.

From the point of view of ensuring the conditions for meeting the objectives of the WMP CR, it is crucial that the given technology is operated at the time when a shortage of the capacities required for the preferred handling of the given waste stream is already becoming evident.

The construction of each facility requires a different time demand associated with project preparation and approval processes up to the actual physical construction of the facility and its commissioning. This represents the time reserve by which work must start earlier than the moment when the capacity of the given technology/facility can be available.

Each type of facility requires a different length of time necessary for the transition from the intention to implementation and commissioning. In the case of large, investment-intensive units, the total time demand is in the range of 5 to 10 years. The construction itself then takes approximately 2 to 4 years.

The prepared scenarios for the development of waste generation and treatment methods by 2035 were used to produce the long-term forecast of expected investment costs.

(a) Municipal Waste

Municipal waste is, from the all-society perspective and the direct impact on inhabitants, a very significant waste stream. Municipal waste and its management significantly affect the fulfilment of the objectives defined within the WMP CR. This concerns both objectives related to the management of municipal waste and objectives associated with the take-back of products with an end of life. The infrastructure for the management of municipal waste is therefore key to the satisfaction of inhabitants, as well as to the safe and efficient handling of waste and products that are managed within technologies serving for municipal waste management.

The following tables present the assumed capacity needs of new or reconstructed technologies, including the assumed investments in these technologies primarily ensuring the management of municipal waste in the individual key periods:

- by 2030,
- 2030–2035,
- in total by 2035.

The following table (*Table 65*) shows the need for capacities of new facilities under the waste generation scenario T1, the waste generation scenario T2, and the waste generation scenario T3, and the need for capacities within the reconstruction of facilities and technologies for waste management in the period by 2030.

It follows from the table that under the **waste generation scenario T1N1, the need for new capacities** of facilities primarily for the management of municipal waste **amounts to 2.7 million tonnes/year by**

2030. The highest capacity need is for transfer stations (0.7 million tonnes/year) and sorting lines for mixed municipal waste (0.6 million tonnes/year).

Under the waste generation scenario T1N2, the need for new capacities of facilities primarily for the management of municipal waste **amounts to 3,756 thousand tonnes/year by 2030.** The highest need for new capacities is for transfer stations (1,036 thousand tonnes/year), facilities for energy recovery of waste (FERW) (913 thousand tonnes/year), and sorting lines for mixed municipal waste (601 thousand tonnes/year).

Under the waste generation scenario T1N3, the need for new capacities of facilities primarily for the management of municipal waste **amounts to 3,945 thousand tonnes/year by 2030.** The highest capacity need is for transfer stations (1,061 thousand tonnes/year), facilities for energy recovery of waste (FERW) (913 thousand tonnes/year), and sorting lines for mixed municipal waste (866 thousand tonnes/year).

Under the **waste generation scenario T2N1, the need for new capacities** of facilities primarily for the management of municipal waste **amounts to 3,038 thousand tonnes/year by 2030.** The highest need for new capacities is for transfer stations (835 thousand tonnes/year), facilities for energy recovery of waste (FERW) (468 thousand tonnes/year), and sorting lines for mixed municipal waste (584 thousand tonnes/year).

Under the **waste generation scenario T2N2, the need for new capacities of facilities** primarily for the management of municipal waste **amounts to 4,309 thousand tonnes/year by 2030.** The highest need for new capacities is for transfer stations (1,196 thousand tonnes/year), facilities for energy recovery of waste (FERW) (1,013 thousand tonnes/year), and sorting lines for mixed municipal waste (966 thousand tonnes/year).

Under the **waste generation scenario T2N3, the need for new capacities of facilities** primarily for the management of municipal waste **amounts to 4,395 thousand tonnes/year by 2030.** The highest need for new capacities is for transfer stations (1,232 thousand tonnes/year), facilities for energy recovery of waste (FERW) (1,063 thousand tonnes/year), and sorting lines for mixed municipal waste (966 thousand tonnes/year).

From the point of view of the **reconstruction of facilities** primarily for the management of municipal waste, **in the case of the waste generation scenarios T1N1–T2N3 the amount of required capacities reached 637 thousand tonnes/year by 2030.** For the reconstruction of infrastructure, scenarios are no longer considered; instead, the same value of investments for reconstruction is considered for all scenarios.

Table 65: Need to build key capacities for municipal waste (million t) – period by 2030

Type of Investment	Scenario	Energy Recovery of Waste (FERW)	Sorting Line for Mixed Municipal Waste	Treatment and Sorting of Bulky Waste	Composting Plant	Biogas Plant	Hygienisation	Sorting Line – Plastics	Sorting Line – Paper	Transfer Stations	Production of Solid Recovered Fuel (SRF)
New capacities	T1N1	0.4	0.2	0.4	0.2	0.1	0.1	0.1	0.02	0.6	0.3
	T1N2	0.8	0.8	0.4	0.2	0.1	0.1	0.1	0.02	1.0	0.6
	T1N3	0.8	0.8	0.4	0.2	0.1	0.1	0.1	0.02	1.0	0.7
	T2N1	0.5	0.4	0.5	0.2	0.1	0.1	0.1	0.01	0.7	0.4
	T2N2	0.9	0.9	0.5	0.2	0.1	0.1	0.1	0.01	1.1	0.7
	T2N3	0.9	0.9	0.5	0.2	0.1	0.1	0.1	0.01	1.2	0.7
Renovation	T1N1-T2N3	0.2	0.0	0.0	0.2	0.0	0.0	0.2	0.09	0.0	0.0

Source: own processing

In all the assumed scenarios of generation and management of municipal waste, the greatest need to build new capacities by 2030 lies in the area of energy recovery of municipal waste and transfer stations for municipal waste. The counter pole is capacities for supplementary sorting of paper.

Table*66: Required level of investment for municipal waste (CZK billion) – period by 2030*

Type of Investment	Scenario	Energy Recovery of Waste (FERW)	Sorting Line for Mixed Municipal Waste	Treatment and Sorting of Bulky Waste	Composting Plant	Biogas Plant	Hygienisation	Sorting Line – Plastics	Sorting Line – Paper	Transfer Stations	Production of Solid Recovered Fuel (SRF)
New capacities	T1N1	14.3	2.1	1.1	0.7	2.1	0.3	1.8	0.4	1.5	2.6
	T1N2	29.1	6.8	1.1	0.7	2.1	0.3	1.8	0.4	2.5	5.2
	T1N3	29.1	7.2	1.1	0.7	2.1	0.3	1.8	0.4	2.6	6.0
	T2N1	16.9	3.6	1.3	0.8	1.9	0.3	1.4	0.3	2.0	3.6

	T2N2	32.8	8.1	1.3	0.8	1.9	0.3	1.4	0.3	3.0	5.9
	T2N3	34.7	8.1	1.3	0.8	1.9	0.3	1.4	0.3	3.1	6.2
Renov ation	T1N1-T2N3	3.2	0.0	0.0	0.5	0.0	0.0	4.6	2.1	0.0	0.0

Source: own processing

The highest investment expenditures by 2030 are represented by technologies for energy recovery of waste, which are higher by an order of magnitude than any other investments. Significant investment expenditures can also be expected for the construction of technologies for mechanical sorting of mixed municipal waste.

Low investment expenditures can be expected by 2030 for facilities for hygienisation of biodegradable waste of animal origin and for supplementary sorting of paper.

Table67: *Need to build capacities for municipal waste (million t) – period 2030–2035*

Type of Invest ment	Scenar io	Energy Recovery of Waste (FERW)	Sorting Line for Mixed Municipal Waste	Treatment and Sorting of Bulky Waste	Composting Plant	Biogas Plant	Hygienisation	Sorting Line – Plastics	Sorting Line – Paper	Transfer Stations	Production of Solid Recovered Fuel (SRF)
New capaciti es	T1N1	0.0	0.0	0.0	0.2	0.2	0.2	0.1	0.0	0.0	0.1
	T1N2	0.0	0.0	0.0	0.2	0.2	0.2	0.1	0.0	0.0	0.2
	T1N3	0.0	0.0	0.0	0.2	0.2	0.2	0.1	0.0	0.0	0.2
	T2N1	0.0	0.0	0.1	0.2	0.2	0.2	0.1	0.0	0.1	0.1
	T2N2	0.0	0.0	0.1	0.2	0.2	0.2	0.1	0.0	0.1	0.1
	T2N3	0.0	0.0	0.1	0.2	0.2	0.2	0.1	0.0	0.0	0.1
Renov ation	T1N1-T2N3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: own processing

After 2030, unlike the period 2025–2030, the need for significant new capacities is not expected, save for exceptions.

Table68: *Required amount of investments for municipal waste (CZK billion) – period 2030–2035*

Type of Investment	Scenario	Energy Recovery of Waste (FERW)	Sorting Line for Mixed Municipal Waste	Treatment and Sorting of Bulky Waste	Composting Plant	Biogas Plant	Hygienisation	Sorting Line – Plastics	Sorting Line – Paper	Transfer Stations	Production of Solid Recovered Fuel (SRF)
New capacities	T1N1	0.0	0.0	0.0	0.6	2.7	0.4	1.8	0.5	0.1	1.3
	T1N2	0.0	0.0	0.0	0.6	2.7	0.4	1.8	0.5	0.1	1.5
	T1N3	0.0	0.0	0.0	0.6	2.7	0.4	1.8	0.5	0.1	2.2
	T2N1	0.0	0.0	0.3	0.7	2.5	0.4	1.4	0.4	0.1	1.1
	T2N2	0.0	0.0	0.3	0.7	2.5	0.4	1.4	0.4	0.2	1.0
	T2N3	0.0	0.0	0.3	0.7	2.5	0.4	1.4	0.4	0.0	0.8
Renovation	T1N1-T2N3	6.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: own processing

After 2030, lower investment expenditures can be assumed than in the period 2025 to 2030. In the period after 2030, higher investment costs are only for biogas plants and sorting lines for plastics and for the production of alternative fuels. Nevertheless, the need for investments in the modernisation of facilities for energy recovery of waste (FERW) can be assumed.

Table69: *Need to build capacities for municipal waste (million t) – total by 2035*

Type of Investment	Scenario	Energy Recovery of Waste (FERW)	Sorting Line for Mixed Municipal Waste	Treatment and Sorting of Bulky Waste	Composting Plant	Biogas Plant	Hygienisation	Sorting Line – Plastics	Sorting Line – Paper	Transfer Stations	Production of Solid Recovered Fuel (SRF)
New capacities	T1N1	0.4	0.2	0.4	0.4	0.3	0.3	0.2	0.04	0.6	0.4
	T1N2	0.8	0.8	0.4	0.4	0.3	0.3	0.2	0.04	1.0	0.7
	T1N3	0.8	0.8	0.4	0.4	0.3	0.3	0.2	0.04	1.0	0.9
	T2N1	0.5	0.4	0.6	0.5	0.3	0.3	0.1	0.03	0.8	0.5
	T2N2	0.9	0.9	0.6	0.5	0.3	0.3	0.1	0.03	1.2	0.8
	T2N3	0.9	0.9	0.6	0.5	0.3	0.3	0.1	0.03	1.2	0.9
Renovation	T1N1-T2N3	0.5	0.0	0.0	0.2	0.0	0.0	0.2	0.09	0.0	0.0

Source: own processing

Overall, in the period 2025–2035 it will be necessary to build key facilities for the management primarily of municipal waste or the outputs of its treatment with a capacity of 2.5 to 5 million tonnes of waste. These capacities are distributed among various groups of waste treatment or final disposal technologies.

As part of the reconstruction of existing capacities, it will be necessary to modernise facilities with a total capacity of at least 0.9 million tonnes of waste.

Table*70*: *Required amount of investments for municipal waste (CZK billion) – total by 2035*

Type of Investment	Scenario	Energy Recovery of Waste (FERW)	Sorting Line for Mixed Municipal Waste	Treatment and Sorting of Bulky Waste	Composting Plant	Biogas Plant	Hygienisation	Sorting Line – Plastics	Sorting Line – Paper	Transfer Stations	Production of Solid Recovered Fuel (SRF)
New capacities	T1N1	14.3	2.1	1.1	1.4	4.8	0.7	3.6	0.9	1.6	3.9
	T1N2	29.1	6.8	1.1	1.4	4.8	0.7	3.6	0.9	2.7	6.7
	T1N3	29.1	7.2	1.1	1.4	4.8	0.7	3.6	0.9	2.7	8.2
	T2N1	16.9	3.6	1.5	1.5	4.4	0.7	2.8	0.7	2.1	4.7
	T2N2	32.8	8.1	1.5	1.5	4.4	0.7	2.8	0.7	3.2	6.9
	T2N3	34.7	8.1	1.5	1.5	4.4	0.7	2.8	0.7	3.2	8.2
Renovation	T1N1-T2N3	9.6	0.0	0.0	0.5	0.0	0.0	3.3	2.1	0.0	0.0

Source: own processing

In the horizon of the period 2025 to 2035, the total expected investments in technologies primarily ensuring the management of municipal waste according to the defined scenarios range between CZK 32.5 and 65.3 billion.

If the expected investments in the reconstruction and modernisation of key technologies, such as sorting lines for paper and plastics and technologies for handling biowaste, are added, the projected investments will range between CZK 48.4 and 82.7 billion.[8]

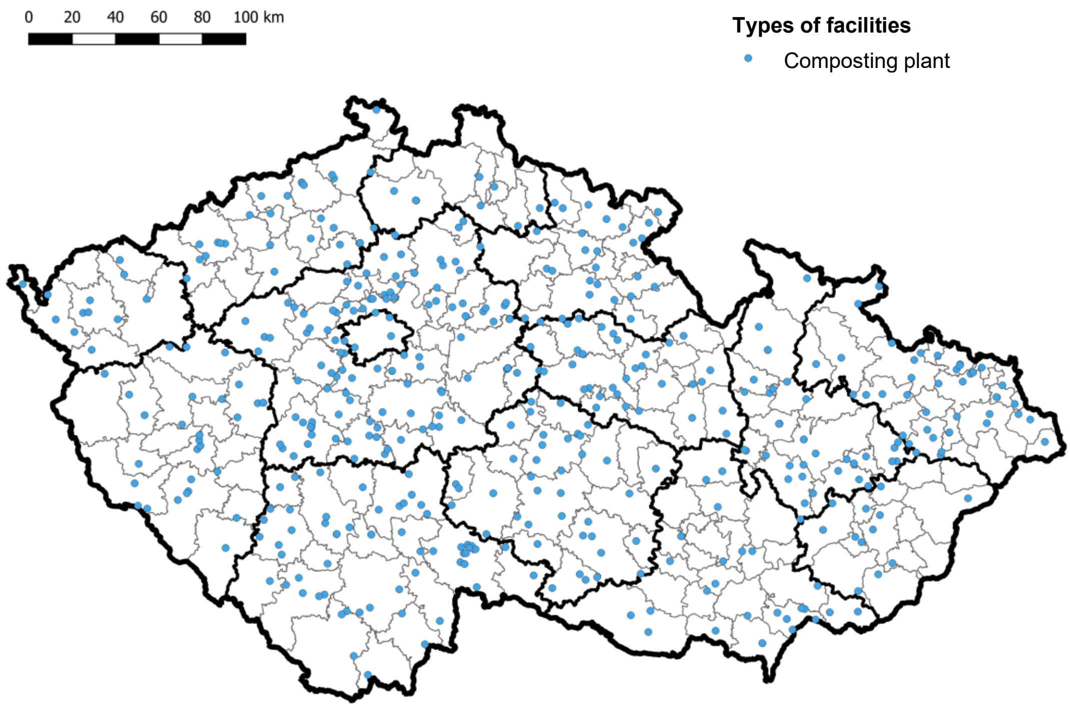
[8] By summing the individual rows in the tables above, an overview can be obtained of the amount of investments under the individual scenarios of the development of waste management. The tables in Chapter 5.2 then show the range between minima and maxima for the scenarios T1N1 and T2N3. It is essential that the individual methods of handling reach their minima and maxima under different scenarios, i.e. a maximum for one method of handling may mean a minimum for another method of handling. It is therefore more indicative to draw on the data from the tables in Chapter 5.2, while here an overview can be obtained of the total costs under the different scenarios.

Long-Term Outlook for the Period 2035 – 2040

Planning investments for the horizon after 2035 is very complicated, primarily in terms of significant legislative changes and the requirements for changes in the behaviour and approach of society to waste management. The degree of success of this transformation will be directly reflected in the need for and adaptation of waste management technologies.

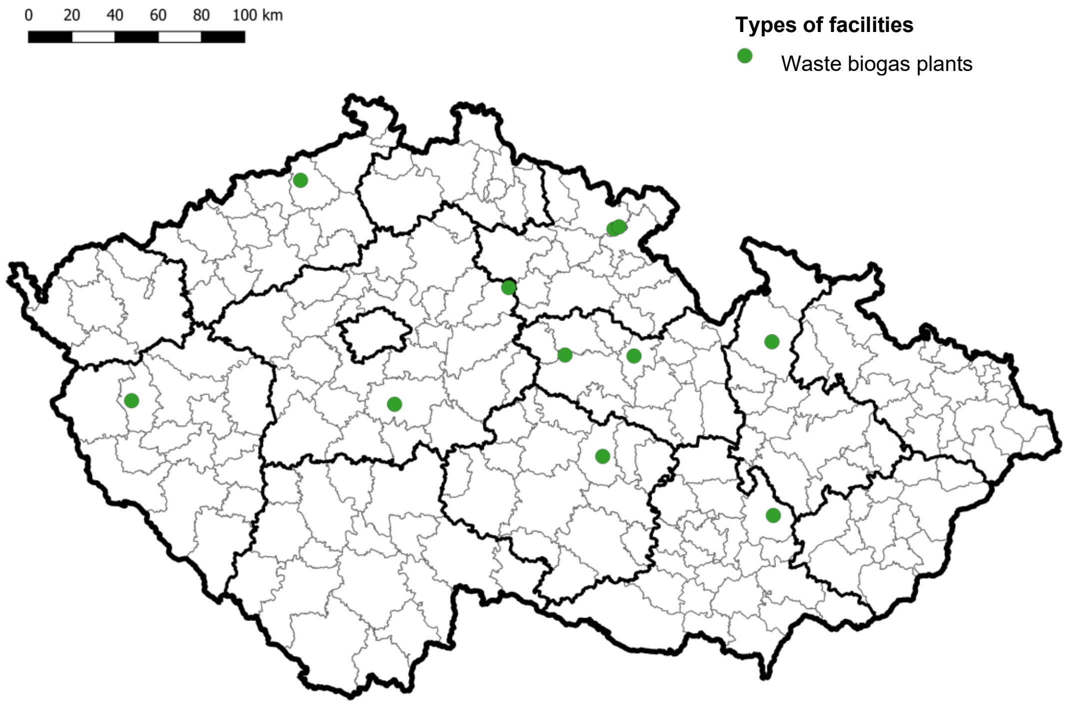
In general, it can be stated that, assuming the development of waste generation and management described in the individual scenarios T1N1–T2N3, a significant proportion of financial resources will be invested in modifications, expansions, and reconstructions of existing facilities so that they are able to manage the generated wastes within the CR in the long term, safely and efficiently.

Figure10: Map of active facilities managing biodegradable waste designated as composting plant, status as at 2022



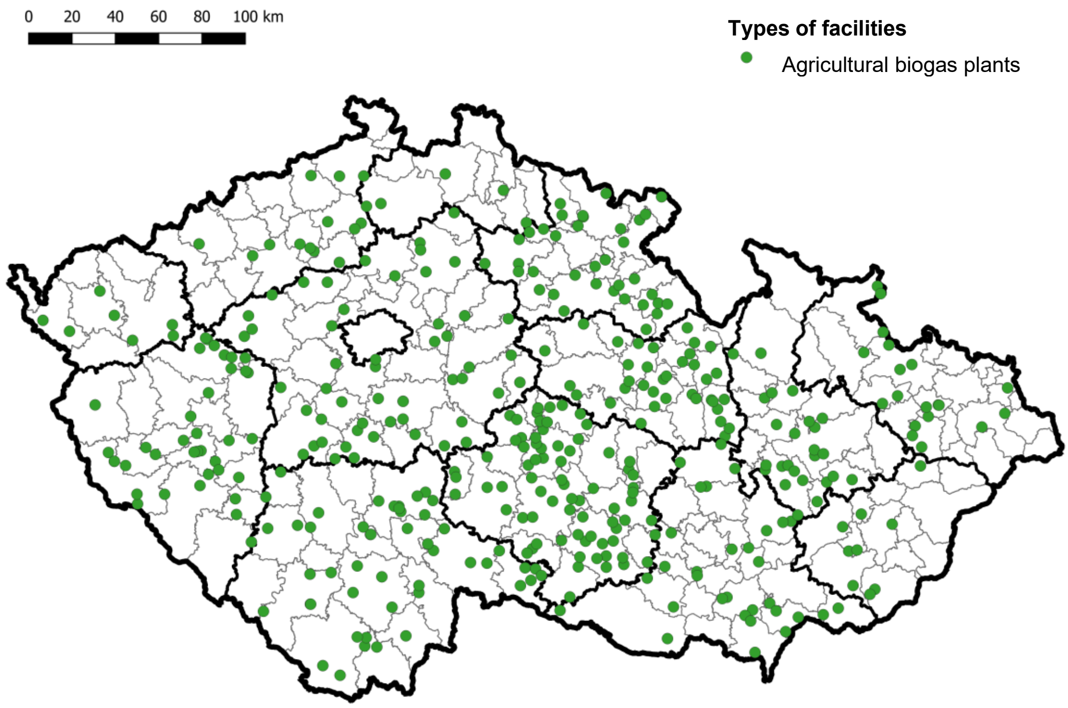
Source: WMIS Facility Register

Figure11: Map of active facilities managing biodegradable waste designated as biogas plants, status as at 2022



Source: WMIS Facility Register

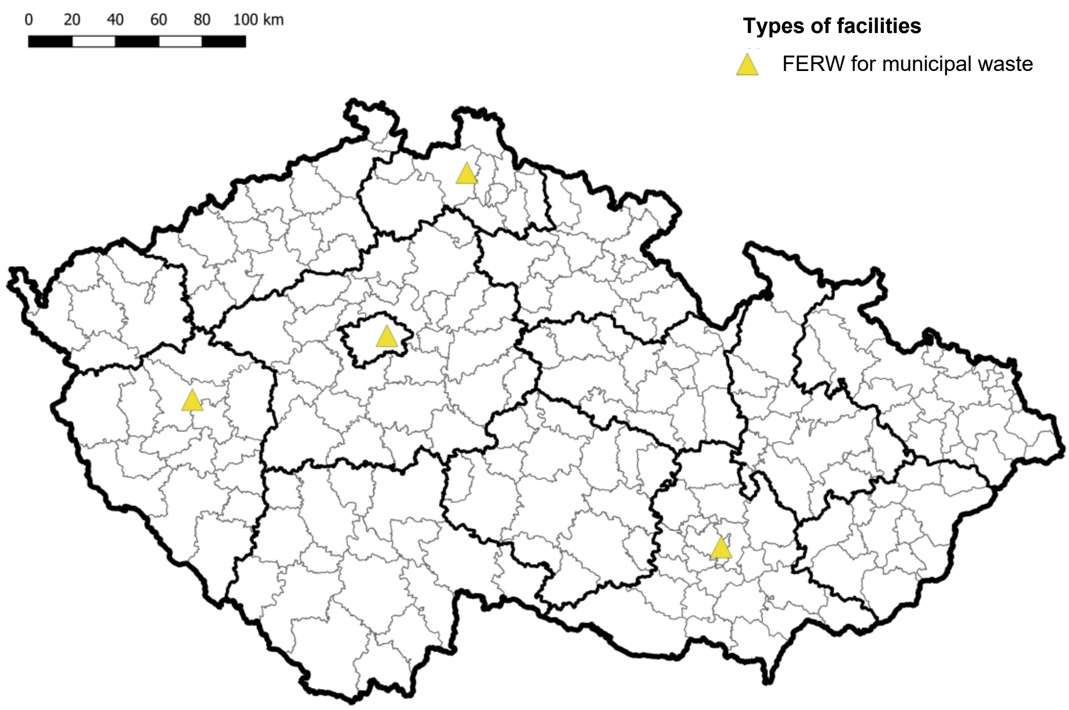
Figure12: Map of agricultural biogas plants, status as at 2022



Source: Czech Biogas Association https://www.czba.cz/mapa-bioplynovych-stanic.html?strana=6#table

Source: WMIS Facility Register

Figure13: Map of active facilities processing mixed municipal waste designated as facilities for energy recovery of waste (FERW), status as at 2022



Source: WMIS Facility Register

(b) Hazardous Waste

By its nature, this is waste with a high risk of endangering human health and the environment. For this reason, it is absolutely essential to ensure sufficient capacities, and thus investment resources, for the proper management of such waste. These are technologies for the treatment of hazardous waste so as to reduce or eliminate its hazardous properties and subsequently enable it to be managed as other waste with the aim of maximising its recycling and recovery.

The second group comprises technologies ensuring the elimination of hazardous properties prior to their final management. This concerns primarily incinerators of hazardous waste.

The third group comprises landfills intended for the permanent disposal of hazardous waste.

Within this chapter, the investment needs are assessed both for ensuring the management of hazardous waste that is currently not managed in the preferred manner and for investments in new capacities for newly arising waste. The second group consists of qualified estimates of the investments needed for the reconstruction of the current network of operated facilities for the management of hazardous waste. From this perspective, investments in the reconstruction of facilities for the thermal treatment of industrial and healthcare waste, whose average age ranges from 15 to 20 years, are absolutely crucial. The oldest incinerator of hazardous waste was built in 1976.

The capacity of de-emulsification stations is almost sufficient for the current generation of hazardous waste. The capacity of neutralisation stations is sufficient for the current generation of hazardous waste. The network of neutralisation stations as well as de-emulsification stations is uneven across the territory of the CR.

Table 71: Need to build capacities for the management of hazardous waste in the period 2025 to 2035 (million t) – hazardous waste treatment technologies

Type of Investment	Period by 2030	Period 2030–2035	Total by 2035
missing capacity at current generation	-	-	-
new capacities due to production growth	0.07	0.08	0.15
reconstruction of existing capacities*	0.14		0.14
Total	0.21	0.08	0.29

Source: own processing

* Based on consultations with experts, it will be necessary to completely reconstruct around 50 per cent of the capacities of technologies for the management of hazardous waste.

Table72: *Required amount of investments for the management of hazardous waste in the period 2025 to 2035 (CZK billion) – stabilisation and biodegradation technologies*

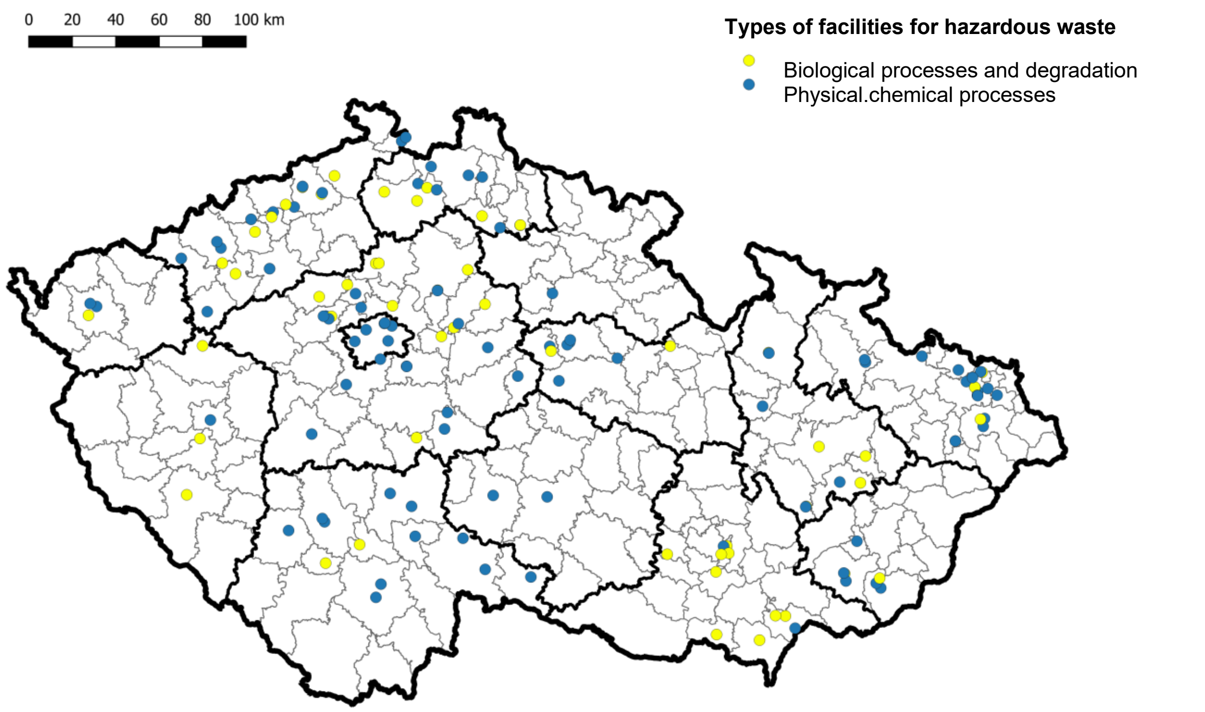
Type of Investment	Period by 2030	Period 2030–2035	Total by 2035
missing capacity at current generation	-	-	-
new capacities due to production growth	0.7	0.8	1.6
reconstruction of existing capacities	1.5		1.5
Total	2.2	0.8	3.1

Source: own processing

It can be expected that investments will need to be secured for the treatment of hazardous waste in the order of 0.3 million tonnes, represented by investment expenditures of around CZK 3.1 billion by 2035. Almost half of the investments can be expected to be for the reconstruction of existing technologies.

For information, an overview is provided of the distribution of facilities primarily for the management of hazardous waste in 2022.

Figure14: Map of active facilities managing hazardous waste designated as biological processes and degradation and physic-chemical processes, status as at 2022



Source: processed on the basis of WMIS

Incinerator of hazardous waste

Incinerators for hazardous waste are a key technology for the safe management of combustible hazardous waste. In the Czech Republic, 21 incinerators of hazardous waste are operated with a total processing capacity of 104 thousand tonnes, of which six facilities are hospital incinerators with a capacity of 8.5 thousand tonnes. At the current level of hazardous waste generation, the Czech Republic lacks incineration capacity for hazardous waste of roughly 45 thousand tonnes. The quantity of this waste is still increasing. Moreover, almost 16% of this waste is processed in a non-preferred manner *(XD1 Disposal on land or under the surface of land (landfilling) and XN12 Disposal of waste as technological material for landfill operation).*

The service life of current incinerators of hazardous waste ranges from 15 to 25 years. For this reason, it is evident that comprehensive reconstruction or replacement of part of their capacity will be absolutely crucial, together with the construction of new incinerators in the next five years, to maintain sufficient capacity for the safe disposal of hazardous waste.

The following table presents the assumption of the required capacities.

Table73: Need to build capacities of facilities for the management of hazardous waste in the period 2025 to 2035 (million t) – incinerators of hazardous waste

Type of Investment	Period by 2030	Period 2030–2035	Total by 2035
missing capacity at current generation	0.05		0.05
new capacities due to production growth	0.02	0.02	0.04
reconstruction of existing capacities*	0.04		0.04
Total	**0.11**	**0.02**	**0.13**

Source: own processing

* Based on consultations with experts, it will be necessary to completely reconstruct around 50 per cent of the capacities of technologies for the management of hazardous waste.

Table*74*: *Required amount of investments for the management of hazardous waste in the period 2025 to 2035 (CZK billion) – stabilisation and biodegradation technologies*

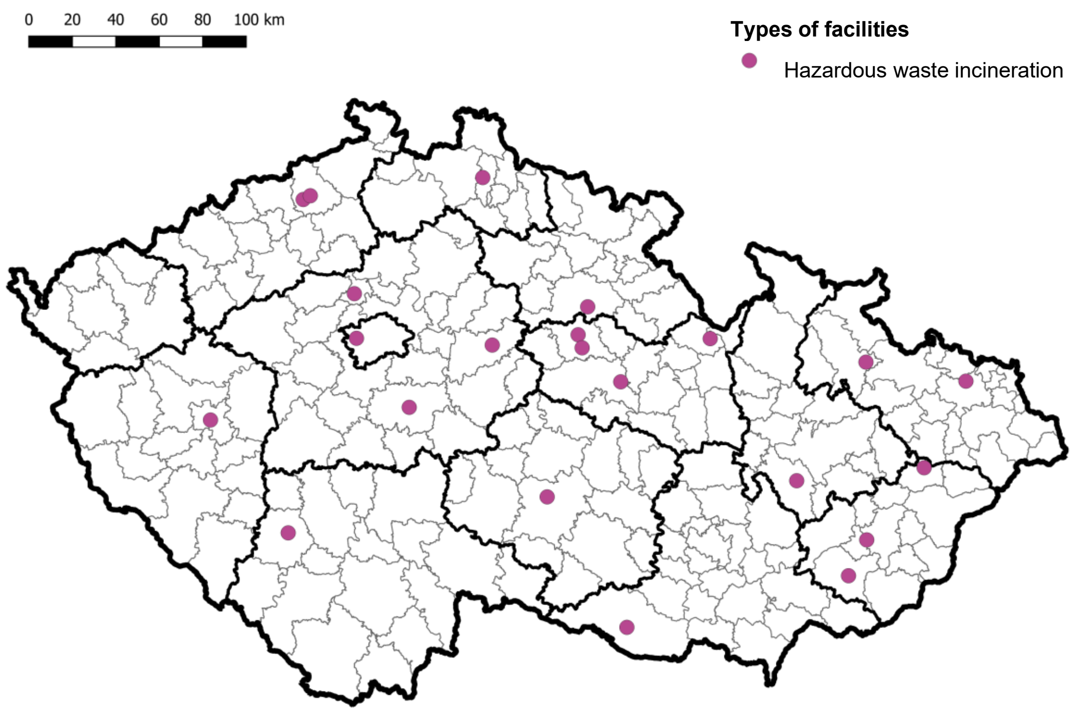
Type of Investment	Period by 2030	Period 2030–2035	Total by 2035
missing capacity at current generation	3.1		3.1
new capacities due to production growth	1.4	1.6	3.0
reconstruction of existing capacities	2.9		2.9
Total	**7.4**	**1.6**	**8.9**

Source: own processing

The capacities of incinerators of hazardous waste will have to increase to almost double the current capacities. From the point of view of the total facility capacities required, this is a small capacity; however, in terms of its significance it is absolutely crucial for ensuring the proper management of hazardous waste. Investment expenditures are significantly higher compared to other methods of managing hazardous waste.

For information, an overview of the distribution of facilities in the territory of the CR in 2022 is presented.

Figure15: Map of active facilities managing hazardous waste designated as waste incineration, status as at 2022



Source: WMIS Facility Register

Stabilisation and biodegradation technologies

The capacity of biodegradation areas is not sufficiently distributed across the territory of the Czech Republic. The capacity of stabilisation lines, in relation to the current generation of hazardous waste suitable for stabilisation, is not sufficient and from a nationwide perspective there is a deficit of 25 to 30 thousand tonnes. In meeting the forecast for hazardous waste, capacities should be increased and appropriately distributed across the territory of the CR.

Table*75*: *Need to build capacities for the management of hazardous waste in the period 2025 to 2035 (million t) – stabilisation and biodegradation technologies*

Type of Investment	Period by 2030	Period 2030–2035	Total by 2035
missing capacity at current generation	0.03		0.03
new capacities due to production growth	0.03		0.03
reconstruction of existing capacities	0.46		0.46
Total	**0.52**		**0.52**

Source: own processing

* Based on consultations with experts, it will be necessary to completely reconstruct around 50 per cent of the capacities of technologies for the management of hazardous waste.

Table76: *Required amount of investments for the management of hazardous waste in the period 2025 to 2035 (CZK billion) – stabilisation and biodegradation technologies*

Type of Investment	Period by 2030	Period 2030–2035	Total by 2035
missing capacity at current generation	0.02		0.02
new capacities due to production growth	0.02		0.02
reconstruction of existing capacities	0.31		0.31
Total	**0.35**		**0.35**

Source: own processing

The greatest need for new capacities is in technologies associated with the stabilisation and biodegradation of hazardous waste. Investment expenditures are, however, very low compared to other technologies for the management of hazardous waste.

Landfilling of hazardous waste

A separate chapter concerns landfills for the disposal of treated and untreated hazardous waste, the capacity of which must be monitored with regard to ensuring the necessary capacities in the future.

The expectation of landfilling treated hazardous waste to S-IO and S-OO landfills will represent approximately 220 to 250 thousand tonnes each year. Therefore, for the period 2025–2035 it is necessary to ensure capacity of around 2.5 million tonnes.

The expectation of landfilling hazardous waste to hazardous-waste landfills S-NO will represent approximately 850 to 950 thousand tonnes each year. Therefore, for the period 2025–2035 it is necessary to ensure capacity of around 10 million tonnes. Part of the waste with hazardous properties will, however, be directed to FERW in accordance with the permitted operating rules of the individual facilities.

(c) Construction and Demolition Waste

These primarily concern investments in technologies for crushing and recycling into recyclates for reuse back in construction production. These are technologies providing the dismantling of structures, subsequent crushing, and recycling into recyclates of the required size fractions.

In the case of stationary lines for the recycling of construction and demolition waste, it is necessary to equip existing lines with wet washing technology, which has a positive effect on the quality parameters of the recyclate produced (removal of the fine fraction, which is unsuitable for the use of recyclates as filler in concrete and other building materials). The presence of a water management system will also have a positive effect in reducing the dustiness of the lines.

Processing of Construction and Demolition Waste

Table77: *Need to build capacities for construction and demolition waste in the period 2025 to 2035 (million t) - processing of construction and demolition waste*

Type of Investment	Period by 2030	Period 2030–2035	Total by 2035
missing capacity at current generation	-	-	-
new capacities due to production growth	1.0	1.0	2.0
reconstruction of existing capacities	3.6		3.6
Total	**4.6**	**1.0**	**5.6**

Source: own processing

* Based on consultations with experts, it can be assumed that reconstruction or supplementation of existing technologies will be required to the extent of around 50 per cent of the capacities of technologies for the management of construction waste.

Table78: *Required amount of investments for construction and demolition waste in the period 2025 to 2035 (CZK billion) -processing of construction and demolition waste*

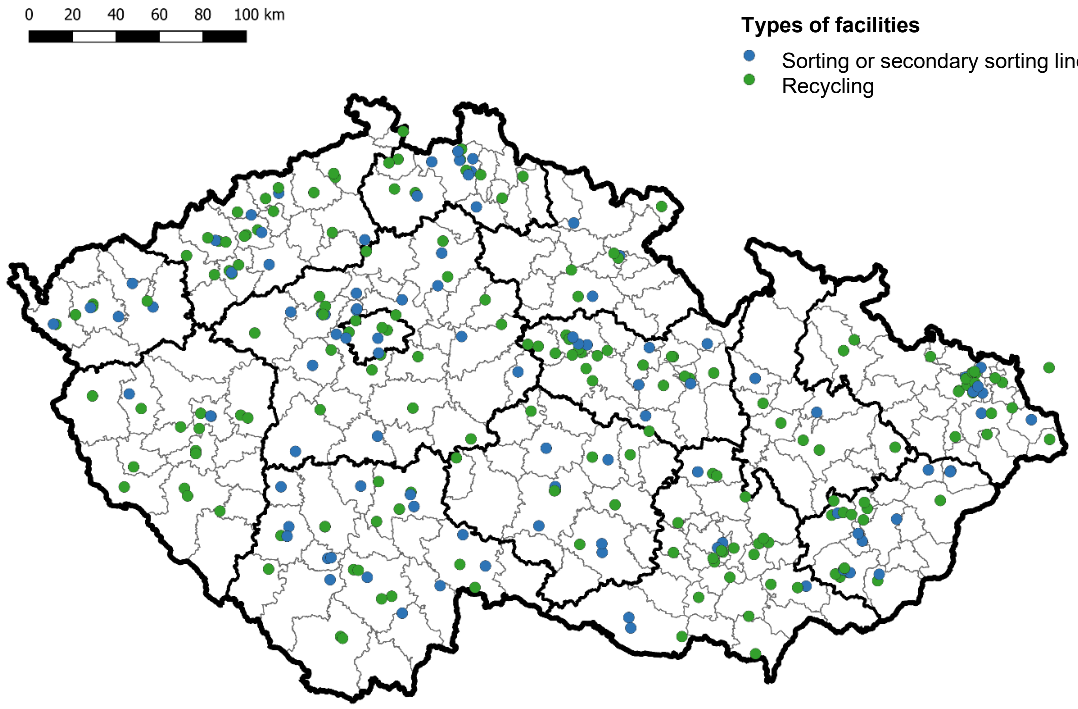
Type of Investment	Period by 2030	Period 2030–2035	Total by 2035
missing capacity at current generation	-	-	-
new capacities due to production growth	0.3	0.3	0.6
reconstruction of existing capacities	1.1		1.1
Total	**1.4**	**0.3**	**1.7**

Source: own processing

Technologies for the processing of construction and demolition waste will, in the horizon of the years 2025 to 2035, require the reconstruction and supplementation of existing technologies and the construction of new technologies in a total of around 5.6 million t. Investment expenditures can be assumed in the period 2025 to 2035 in the volume of 1.7 billion CZK

For information, an overview of the distribution of facilities in the territory of the CR is provided, status as at 2022.

Figure16: Map of active facilities managing construction and demolition waste designated as recycling and sorting or supplementary sorting line, status as at 2022



Source: WMIS Facility Register

Further Recovery of Construction and Demolition Waste

The expectation for the recovery of construction waste is also as technical landfill cover. This concerns a capacity of roughly 1 million tonnes per year. For the period 2025 to 2035 it is therefore necessary to ensure a capacity of around 10 million tonnes. However, a decline in this method of handling construction and demolition waste can be expected in connection with the fundamental reduction of waste landfilling.

The recovery of part of the waste from selective demolitions that is unsuitable for material recycling will take place in the released capacities of facilities for energy recovery of waste (FERW), in connection with the decreasing generation of mixed municipal waste and bulky municipal waste, primarily in the period 2030 to 2035.

Landfilling of Construction and Demolition Waste

The expectation for the landfilling of construction and demolition waste that cannot be recovered in any way will represent approximately 5 million t in the period 2025–2035. A significant decline in landfilling is expected in the period by 2030. In the period 2030–2035 there will only be a slight year-on-year decrease in the waste landfilled.

(d) Investments in New Technologies to Ensure One Hundred Per Cent Recycling of the Generated Quantity of Material-Recoverable Waste in the Territory of the Czech Republic

Paper and Cardboard

Material recovery of waste paper took place in 2022 in regions where paper mills are operated. Nevertheless, capacities for paper recycling are insufficient for the recycling of waste paper in the CR. In 2022, the Czech Republic was a strong exporter of paper waste. The difference between the export and import of waste paper amounted to 700 thousand tonnes, with the difference between the export and import of the defined stream (i.e. category numbers 20 01 01, 15 01 01 and 03 03 08) being 0.4 million tonnes in 2022. The remaining 0.3 million tonnes is the difference between the export and import of waste paper (19 12 01).

Waste paper and cardboard are a freely tradable commodity, and their recycling is linked to the construction of large investment units of paper mills. The construction of new facilities is tied to suitable locations. The assumptions for the construction of facility capacities are given in the tables below.

Since paper is handled predominantly in the preferred manner, the current deficit of capacities of facilities for the recycling of waste paper for the whole of the Czech Republic is given precisely by the net balance of cross-border shipments in the amount of 0.7 million tonnes. The created scenarios of waste generation up to 2035 anticipate a future increase in the generation of waste paper, up to a value around 1.4 million tonnes in 2035, which further increases the need for processing capacities by 300 thousand tonnes. By 2035, due to the growth in the generation of waste paper, a **missing capacity of approximately 1 million tonnes** can be assumed.

Table 79: Need to build capacities for the recycling of paper and cardboard only in the territory of the CR in the period 2025 to 2035 (million t)

Type of Investment	Period by 2030	Period 2030–2035	Total by 2035
missing capacity at current generation	0.7		0.7
new capacities due to production growth	0.2	0.1	0.3
Total	**0.9**	**0.1**	**1.0**

Source: own processing

According to the table (Table 79)), there is a need to increase paper processing capacities in the CR by 1 million tonnes by 2035 in the event that the CR is to be able to process all generated waste paper within its own capacities.

Table*80*: *Required amount of investments for the recycling of paper and cardboard in the territory of the CR in the period 2025 to 2035 (CZK billion)*

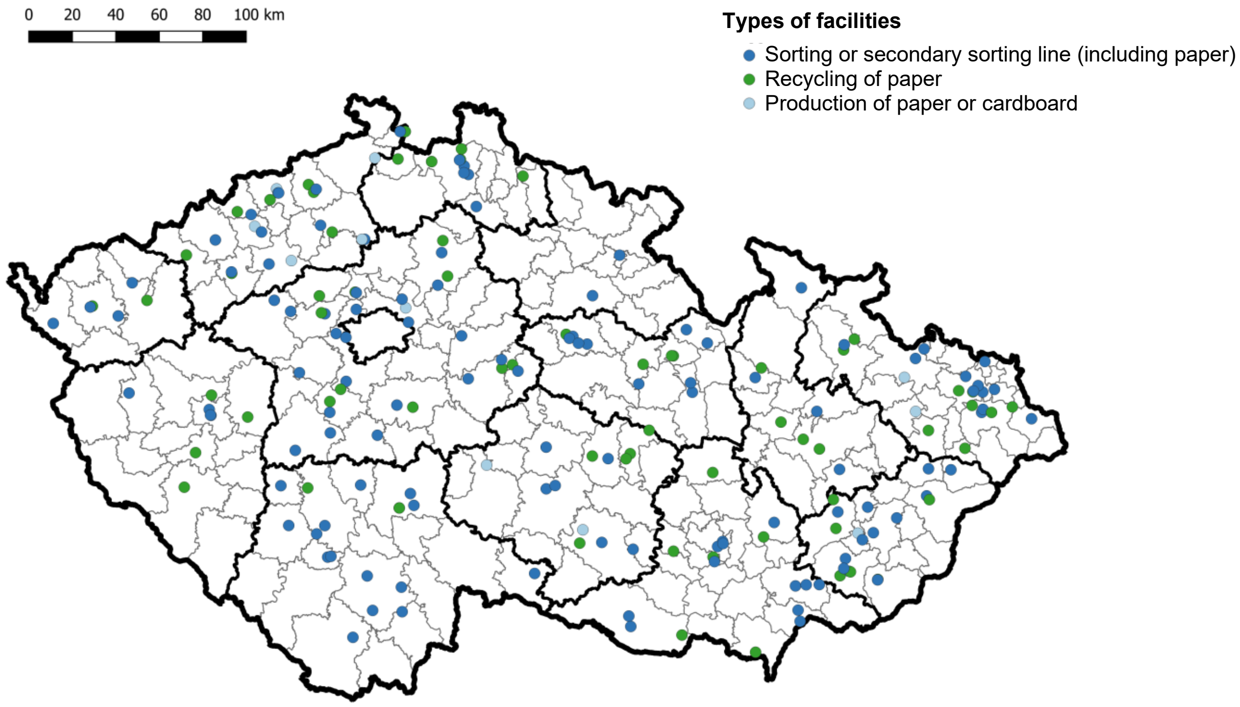
Type of Investment	Period by 2030	Period 2030–2035	Total by 2035
missing capacity at current generation	31.5		31.5
new capacities due to production growth	9.0	4.5	13.5
Total	**40.5**	**4.5**	**45**

Source: own processing

In the event of a requirement to ensure the recycling of paper and cardboard in the CR, it is assumed that processing capacities will need to be supplemented in a total of around 1 million tonnes by 2035. The anticipated investment expenditures for these capacities will represent 45 billion CZK.

For information, an overview of the distribution of facilities in the territory of the CR is provided, status as at 2022.

Figure17: Map of active facilities managing paper designated as sorting or supplementary sorting line, recycling, and the production of paper or cardboard, status as at 2022



Source: WMIS Facility Register

Plastics

Overall, in 2022 the Czech Republic shows a deficit of preferred processing of plastic waste in the amount of over 80 thousand tonnes. This deficit relates primarily to plastic waste from packaging from other waste holders.

Technologies for the recycling of plastics differ significantly in relation to the waste processed. The quality of input waste and the requirements for the qualitative parameters of the treated waste and the raw material produced determine the costs of waste recycling.

A significant part of investments is associated with the needs for waste treatment by supplementary sorting, washing, crushing, and sorting using optical detection, and, above all, with the requirements for the output, its purity, and technical parameters.

Investment costs per unit range between CZK 10 to 22 thousand per tonne in the case of mechanical recycling and in the order of higher tens of thousands of CZK per tonne in the case of innovative thermochemical technologies.

Given the trend in the generation of plastic waste, growth is essential only in separate collection within municipal waste. For the reasons stated above, the modelling of the necessary increase in capacities and the resulting investments is based on the development of the separate collection of plastics within municipal waste. To this, the missing capacity of 0.15 million tonnes of processing capacity in 2022 (non-preferred handling) is added.

Table81: *Need to build capacities to ensure the recycling of plastic waste in the territory of the CR in total by 2035 (million t)*

Type of Investment	Period by 2030	Period 2030–2035	Total by 2035
missing capacity at current generation	0.1		0.1
new capacities due to production growth	0.1	0.1	0.2
Total	**0.2**	**0.1**	**0.3**

Source: own processing

It follows from the table that the current need to increase processing capacity, with regard to the growth of separately collected quantities and the efficiency of sorting lines, should rise by 0.2 million tonnes by 2035. In 2022, 0.1 million tonnes of plastic waste were managed in a non-preferred manner, which can also be considered as missing capacity within the CR. Overall, processing capacity for the processing of plastic waste in the CR should increase by approx**. 0.3 million tonnes** so as to ensure self-sufficiency in the processing of plastic waste.

Table82: *Required amount of investments to ensure capacity for the recycling of plastic waste in the territory of the CR in the period 2025 to 2035 (CZK billion)*

Type of Investment	Period by 2030	Period 2030–2035	Total by 2035
missing capacity at current generation	1.2		1.2
new capacities due to production growth	1.2	1.8	3.0
Total	**2.4**	**1.8**	**4.2**

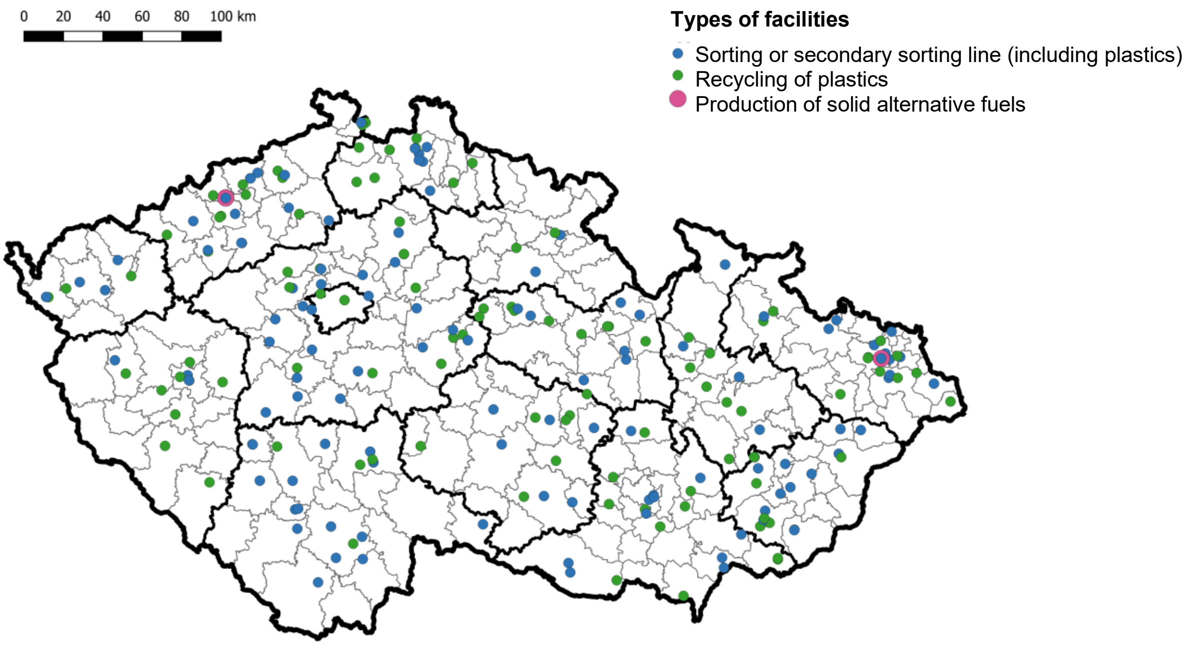
Source: own processing

Overall, processing capacity for the processing of plastic waste in the CR should increase by approx. 0.3 million tonnes so as to ensure self-sufficiency in the processing of plastic waste.

The anticipated investment expenditures are at the level of around CZK 4.2 billion.

For information, an overview of the distribution of facilities in the territory of the CR is provided, status as at 2022.

Figure18: Map of active facilities managing plastics designated as sorting or supplementary sorting line, recycling, and the production of solid alternative fuels, status as at 2022



Source: WMIS Facility Register

Metals

Ferrous and non-ferrous metal waste is the subject of import and export. Export, however, strongly predominates. Approximately 700 thousand tonnes of waste metals are imported annually; over 2.4 million tonnes of waste metals are exported annually. The difference between export and import thus amounts to 1.67 million tonnes, with the difference between the export and import of the defined stream amounting to 0.83 million tonnes in 2022. A further 0.84 million tonnes constitutes the difference between the export and import of waste iron arising in group 19 (cat. Nos 19 10 01, 19 12 02, 19 12 03).

Since metals are handled predominantly in the preferred manner, the current deficit of capacities of facilities for the recycling of metals for the whole of the Czech Republic is given precisely by the net balance of cross-border shipments in the amount of 1.7 million tonnes. The waste generation scenarios developed by 2035 do not assume any significant increase in the generation of metal waste. The current generation of metals from separate collection totalled 388 thousand tonnes in 2022. The scenarios created anticipate a future increase in the generation of waste metal to values around 480 thousand tonnes in 2035, which further increases the need for processing capacities by roughly 100 thousand tonnes. If generation were to be covered by domestic facilities, the total capacity deficit by 2035 is estimated at 1.8 million tonnes. Metal recycling depends on the existence of large technological units. At the time of preparation of this study in 2023, the situation in the metallurgy sector is difficult and production is being curtailed. For the recycling of metals, electric arc furnaces can be utilised, which process only scrap. The quality of output steel depends on the quality of the charge. It follows that the quality of the material input to the facility will affect the quality of the output.

Hybrid furnaces make it possible to process ore together with iron scrap. The advantage is the ability to influence the quality of output steel. In the event of a shortage of iron ore, pellets can be processed. Unfortunately, pellets are not produced within the European Union, and it would be necessary to ensure their import. Investment in hybrid-furnace technology is around EUR 400 million for a capacity of 1.5 million tonnes. Investment costs per unit range between CZK 6 to 8 million per tonne.

Modelling the development of the collection of metal waste does not have a fundamental effect on the total capacity required. Decisive is the current export of metal waste generated by all waste holders. The generation of metal waste is strongly dependent on one-off demolitions and the generation of scrap metal in the renewal of technologies. The trend of this renewal and demolitions cannot be predicted and has therefore not been included in the assumption.

Table 83: Need to build capacities for the recycling of metal waste in the territory of the CR in the period 2025 to 2035 (million t)

Type of Investment	Period by 2030	Period 2030–2035	Total by 2035
missing capacity at current generation	1.7		1.7
new capacities due to production growth	0.05	0.05	0.1
Total	**1.75**	**0.05**	**1.8**

Source: own processing

According to Table 83, the current need to increase processing capacity for the recycling of metal waste should rise by 0.1 million tonnes by 2035 due to the development of the collection and supplementary sorting of metal waste.

In 2022, the balance of cross-border shipments was around 1.7 million tonnes of metal waste, which can be considered as the missing capacity within the CR. Overall, the processing capacity of metal waste in the Czech Republic should increase by 2035 to roughly 1.8 million tonnes so as to ensure self-sufficiency in the processing of metal waste.

Table*84*: *Required amount of investments for the recycling of metal waste in the territory of the CR in the period 2025 to 2035 (CZK billion)*

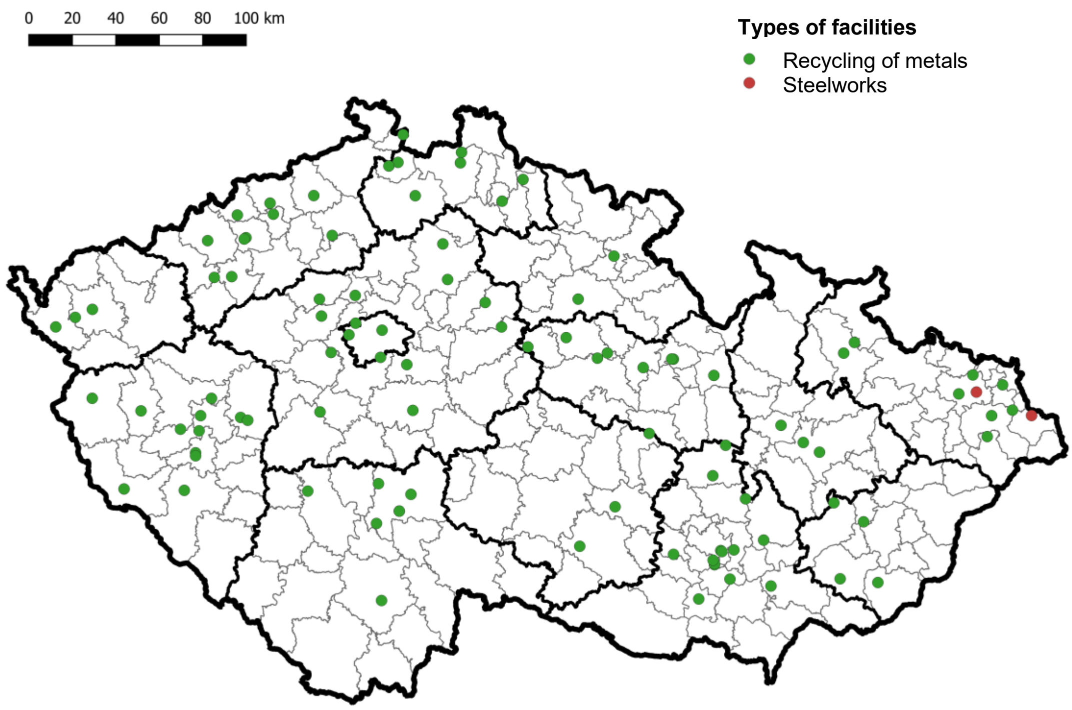
Type of Investment	Period by 2030	Period 2030–2035	Total by 2035
missing capacity at current generation	11.3		11.3
new capacities due to production growth	0.3	0.3	0.6
Total	**11.6**	**0.3**	**11.9**

Source: own processing

The required capacity of technologies for the recycling of metals is around 1.8 million t. Investment expenditures can be assumed at the level of CZK 11.9 billion. A significant influence on the recycling of metals in the CR will be the future development associated with metallurgy operations in the CR.

For information, an overview of the distribution of facilities in the territory of the CR is provided, status as at 2022.

Figure19: Map of active facilities managing metals designated as steelworks and metal recycling as at 2022



Source: WMIS Facility Register

Glass

Within the recycling of waste glass, these are primarily the investments needed to ensure the treatment of waste and the preparation of a very high-quality input raw material for glassworks, or technologies for the production of final products.

Given the trend in the generation of waste glass, growth is essential only in separate collection within municipal waste. In other waste streams there is stagnation or a slight decline. For the reasons stated above, the modelling of the necessary increase in capacities and the resulting investments is based on the development of the separate collection of glass within municipal waste.

Table*85*: *Need to build capacities for the recycling of glass in the territory of the CR in the period 2025 to 2035 (million t)*

Type of Investment	Period by 2030	Period 2030–2035	Total by 2035
missing capacity at current generation	0	0	0
new capacities due to production growth	0.03	0.03	0.06
Total	**0.03**	**0.03**	**0.06**

Source: own processing

It follows from the table that there is a need to increase capacities for the treatment and processing of waste glass in the CR by 0.06 million tonnes by 2035.

Table86: *Required amount of investments for the recycling of glass in the territory of the CR in the period 2025 to 2035 (CZK billion)*

Type of Investment	Period by 2030	Period 2030–2035	Total by 2035
missing capacity at current generation	0	0	0
new capacities due to production growth	0.04	0.04	0.08
Total	**0.04**	**0.04**	**0.08**

Source: own processing

The required capacity of technologies for the recycling of glass is up to approx. 100 thousand tonnes by 2035. The technologies should focus on facilities for the treatment and processing of waste glass into very high-quality input raw materials for glassworks, or technologies for the production of final products. Investment expenditures are very low and are around CZK 0.1 billion.

Textiles

These are investments in technologies for the processing of waste textiles that will not be passed on for re-use.

Given the trend in the generation of waste textiles, growth is essential only in separate collection within municipal waste due to the obligation of its separate collection since 2025. In other waste streams there is stagnation or a slight decline. For the reasons stated above, the modelling of the necessary increase in capacities and the resulting investments is based on the development of the separate collection of textiles.

Table87: *Need to build capacities for the recycling of textiles in the territory of the CR in the period 2025 to 2035 (million t)*

Type of Investment	Period by 2030	Period 2030–2035	Total by 2035
missing capacity at current generation	0	0	0
new capacities due to production growth	0.03	0.04	0.07
Total	**0.03**	**0.04**	**0.07**

Source: own processing

It follows from the table that there is a need to increase capacities in the CR by 0.07 million tonnes by 2035.

Table88: *Required amount of investments for the recycling of textiles in the territory of the CR in the period 2025 to 2035 (CZK billion)*

Type of Investment	Period by 2030	Period 2030–2035	Total by 2035
missing capacity at current generation	0	0	0
new capacities due to production growth	0.4	0.5	0.9

Total	**0.4**	**0.5**	**0.9**

Source: own processing

The required capacity of the increase in current technologies to ensure the processing of waste textiles that will not be passed on for re-use is 70 thousand tonnes. The required capacity for textile recycling by 2035 is up to around 100 thousand tonnes. Investment expenditures are in the order of up to CZK 1 billion..

5.3 Summary of Required Investments

Anticipated Investments in Technologies for the Management of Biowaste

Input Waste
Separate collection from municipalities and other holders – biodegradable waste from kitchens and catering facilities
Waste from the food and processing industry

Hygienisation

		min	max.	total
mil. t	New capacities*	0.3	0.3	0.3 – 0.3
	Reconstruction of capacities**			
CZK billion	New capacities*	0.7	0.7	0.7 – 0.7
	Reconstruction of capacities**			

Input Waste
Treated waste – hygienisation
Waste from the food and processing industry

Biogas Plant

		min	max.	total
mil. t	New capacities*	0.3	0.3	0.3 – 0.3
	Reconstruction of capacities**			
CZK billion	New capacities*	4.4	4.8	4.4 – 4.8
	Reconstruction of capacities**			

Input Waste
Separate collection from municipalities and other holders – biowaste from gardens and parks
Waste from the food and processing industry

Composting Plant

		min	max.	total
mil. t	New capacities*	0.4	0.5	0.6 – 0.6
	Reconstruction of capacities**	0.2		
CZK billion	New capacities*	4.4	4.8	1.9 – 2
	Reconstruction of capacities**	0.5		

Anticipated Capacity Requirements up to 2035	Anticipated Investment Requirements up to 2035
mil. t	CZK billion
1.2 - 1.2	7 - 7.5

Legend:
*new capacities due to increased production
** reconstruction and renewal of existing

Own processing
Notice: the estimates of investment costs (specific) are based on an expert market and literature review from 2023 and may, depending on the development of the economic environment, in reality differ significantly.

Assumed investments in technologies to ensure the treatment of waste from separate collection of recyclable and recoverable waste (paper, plastics)

Input Waste

Separate collection – municipalities
Separate collection - other holders

Re-sorting Line – Paper

		min	max.	total
mil. t	New capacities*	0.03	0.04	0.1 - 0.1
	Reconstruction of capacities**	0.1		
CZK billion	New capacities*	0.7	0.9	2.8 - 3
	Reconstruction of capacities**	2.1		

Re-sorting Line – Plastics

		min	max.	total
mil. t	New capacities*	0.1	0.2	0.3 - 0.4
	Reconstruction of capacities**	0.2		
CZK billion	New capacities*	2.8	3.6	6.1 - 6.9
	Reconstruction of capacities**	3.3		

Anticipated Capacity Requirements up to 2035	Anticipated Investment Requirements up to 2035
mil. t	CZK billion
0.4 - 0.5	8.9 - 9.9

Legend:
*new capacities due to increased production
** reconstruction and renewal of existing capacities

Own processing
Note: The estimates of investment costs (unit costs) are based on an expert market and literature review from 2023 and may differ in reality depending on the development of the economic environment.

Anticipated investments in technologies for the management of primarily municipal waste outside separate collection

Input Waste
Mixed Municipal Waste
Bulky waste
Other primarily municipal waste

Transfer Stations

		min	max.	total
mil. t	New capacities*	0.6	1.2	0.6 - 1.2
	Reconstruction of capacities**			
CZK billion	New capacities*	1.6	3.2	1.6 - 3.2
	Reconstruction of capacities**			

Input Waste
Mixed Municipal Waste

Sorting Line for Mixed Municipal Waste

		min	max.	total
mil. t	New capacities*	0.2	0.9	0.2 - 0.9
	Reconstruction of capacities**			
CZK billion	New capacities*	2.1 1 8.1		2.1 - 8.1
	Reconstruction of capacities**			

Input Waste
Bulky Waste

Treatment and Sorting of Bulky Waste

		min	max.	total
mil. t	New capacities*	0.4	0.6	0.4 - 0.6
	Reconstruction of capacities**			
CZK billion	New capacities*	1.1 1 1.5		1.1 - 1.5
	Reconstruction of capacities**			

Input Waste
Municipal Waste
Industrial Waste
Selected hazardous
Rejects from treatment and processing technologies

Energy Recovery of Waste (FERW)

		min	max.	total
mil. t	New capacities*	0.4	0.9	0.9 - 1.4
	Reconstruction of capacities**	0.5		
CZK billion	New capacities*	14.3	34.7	23.8 - 44.3
	Reconstruction of capacities**	9.6		

Input Waste
Rejects from treatment and processing technologies

Production of Solid Recovered Fuel (SRF)

		min	max.	total
mil. t	New capacities*	0.43	0.91	0.4 - 0.9
	Reconstruction of capacities**			
CZK billion	New capacities*	3.9	8.2	3.9 - 8.2
	Reconstruction of capacities**			

Anticipated Capacity Requirements up to 2035	Anticipated Investment Requirements up to 2035
mil. t	CZK billion
2.5 - 5	32.5 - 65.3

Legend:

Own processing
Note: The estimates of investment costs (unit costs) are based on an expert market and literature review from 2023 and may differ in reality depending on the development of the economic environment.

Anticipated investments in technologies for managing hazardous waste

Input Waste
Hazardous waste primarily from:
- Industry
- Health and veterinary medicine
- Municipal waste
- Waste treatment and processing technologies

Treatment of Hazardous Waste

			total
mil. t	New capacities*	0.15	0.1
	Reconstruction of capacities**	0.0	
CZK billion	New capacities*	1.56	3.1
	Reconstruction of capacities**	1.5	

Incinerator of hazardous waste

			total
mil. t	New capacities*	0.04	0.1
	Reconstruction of capacities**	0.1	
CZK billion	New capacities*	2.98	8.9
	Reconstruction of capacities**	6.0	

Stabilisation and biodegradation

			total
mil. t	New capacities*	0.03	0.5
	Reconstruction of capacities**	0.5	
CZK billion	New capacities*	0.02	0.3
	Reconstruction of capacities**	0.3	

Anticipated Capacity Requirements up to 2035	Anticipated Investment Requirements up to 2035
mil. t	CZK billion
0.8	12.3

Legend:
*new capacities due to increased production
** reconstruction and renewal of existing capacities, including supplementing missing capacities

Own processing
Note: The estimates of investment costs (unit costs) are based on an expert market and literature review from 2023 and may differ in reality depending on the development of the economic environment.

Anticipated Investments in Technologies for the Management of Construction and Demolition Waste

Input Waste

Construction and Demolition Waste

Processing of Construction and Demolition Waste

			total
mil. t	New capacities*	1.98	5.6
	Reconstruction of capacities**	3.6	
CZK billion	New capacities*	0.59	1.7
	Reconstruction of capacities**	1.1	

Anticipated Capacity Requirements up to 2035	Anticipated Investment Requirements up to 2035
mil. t	CZK billion
5.6	1.7

Legend:
***new capacities due to increased production**
**** reconstruction and renewal of existing capacities, including supplementing missing capacities**

Own processing
Note: The estimates of investment costs (unit costs) are based on an expert market and literature review from 2023 and may differ in reality depending on the development of the economic environment.

Anticipated Investments in Technologies to Ensure the Recycling of the Generated Volume of Material-Recoverable Waste within the Territory of the Czech Republic

Input Waste

Separate collection – municipalities
Separate collection - other holders
Outputs from the process of waste treatment and processing
Sorted waste from industry

1

Paper and Cardboard

			total
mil. t	New capacities*	0.3	1.0
	Reconstruction of capacities**	0.7	
CZK billion	New capacities*	13.5	45.0
	Reconstruction of capacities**	31.5	

Plastics

			total
mil. t	New capacities*	0.2	0.3
	Reconstruction of capacities**	0.1	
CZK billion	New capacities*	3.0	4.2
	Reconstruction of capacities**	1.2	

Metal

			total
mil. t	New capacities*	0.1	1.8
	Reconstruction of capacities**	1.7	
CZK billion	New capacities*	0.6	11.9
	Reconstruction of capacities**	11.3	

Glass

			total
mil. t	New capacities*	0.1	0.1
	Reconstruction of capacities**	0.0	
CZK billion	New capacities*	0.1	0.1
	Reconstruction of capacities**	0.0	

Textiles

			total
mil. t	New capacities*	0.1	0.1
	Reconstruction of capacities**	0.0	
CZK billion	New capacities*	1.0	1.0
	Reconstruction of capacities**	0.0	

Anticipated Recycling Capacity in the Czech Republic by 2035.
Anticipated Required Capacity Development for Recycling in the Czech Republic by on the territory of the Czech Republic by the year 2035

mil. t	CZK billion
3.3	62.2

Legend:
***new capacities due to increased production**
****lack of capacity in current production**

Own processing
Note: The estimates of investment costs (unit costs) are based on an expert market and literature review from 2023 and may differ in reality depending on the development of the economic environment.

5.3.1 Distribution of Investments in Waste Treatment Facilities

For an indicative overview of the distribution of investments within the Czech Republic, a qualified assessment of the situation and an estimate of the needs of individual technologies in the Eastern and Western regions of the Czech Republic was carried out for suitable waste streams. A description of the NUTS 2 regions included in the Eastern and Western areas is provided in the following table (Table 89).

Table 89: Division of NUTS 2 Regions

Region East	Region West
CZ06 – Southeast CZ07 – Central Moravia CZ08 – Moravian-Silesian Region	CZ01 – Prague CZ02 – Central Bohemia CZ03 – Southwest CZ04 – Northwest CZ05 – Northeast

Source: own classification

For each waste stream linked to end-of-line technology, the following table (Table 90) describes the principle used to determine the projected total capacity requirements in the individual areas. These considerations must be regarded as very indicative, particularly in view of the free market and the appropriate conditions for constructing specific technologies in given regions/areas. It is always necessary to adopt an individual approach to each investment project, taking into account the intentions and decisions of the investor, including the specific conditions for implementing the project in the given location. For these reasons, **it is not possible to determine the distribution and location of capacities or investments within the individual areas of the Czech Republic with precision.**

Table 90: Principles for the Approach and Determination of Projected Capacity Requirements of Waste Management Facilities in the Czech Republic for the Individual Areas (East/West) by Technology Group

Technology	Estimated capacity requirements in individual areas
Collection network (containers and collection yards)	Cannot be determined – lack of data on the detailed distribution (door to door) and coverage area in individual regions. Lack of detail on the need to develop the public collection network in individual regions. Excessive level of detail with regard to more than 6.5 thousand separate municipalities.
Re-sorting Lines– Paper	Based on the amount of separately collected paper in 2035.
Re-sorting Lines– Plastics	Based on the amount of separately collected plastic in 2035.
Paper and Cardboard	Cannot be determined – dependent on suitable locations and business intentions.
Plastics	Cannot be determined – dependent on suitable locations and business intentions.
Metal	Cannot be determined – dependent on suitable locations and business intentions.
Glass	Cannot be determined – dependent on suitable locations and business intentions.

Technology	Estimated capacity requirements in individual areas
Textiles	Cannot be determined – dependent on suitable locations and business intentions.
Hygienisation	Based on the projected increase in quantities by 2035 – almost identical to the generation of biowaste from kitchens and catering establishments in 2035, due to the minimal generation recorded in 2022.
Biogas Plant	Based on the increase in quantities by 2035, taking into account deficits/surpluses in treatment capacity in 2022, when a surplus was identified in the Central Bohemian Region and a deficit in the Capital City of Prague (treatment took place in the Central Bohemian Region). No impact on distribution East/West.
Composting Plant	Based on the increase in quantities by 2035, taking into account deficits/surpluses in treatment capacity in 2022, when a surplus was identified in the Central Bohemian Region and a deficit in the Capital City of Prague (treatment took place in the Central Bohemian Region). No impact on distribution East/West.
Transfer Stations	Based on the production of mixed municipal waste in 2030.
Sorting Line for Mixed Municipal Waste	According to the share of planned capacities in each region in relation to the total planned capacity for the Czech Republic.
Treatment and Sorting of Bulky Waste	Based on the production of bulky waste in 2030 (the increase in technologies ends), in individual regions, scenario T1.
Energy Recovery of Waste (FERW)	According to the share of planned capacities in each region in relation to the total planned capacity for the Czech Republic.
Production of Solid Recovered Fuel (SRF)	Cannot be determined – dependent on SRF (solid recovered fuel) consumers.
Treatment of Hazardous Waste	Based on the increase in quantities.
Incinerator of hazardous waste	Based on the sub-stream "Waste Exclusively for Hazardous Waste Incineration." The amount is more or less proportional to population distribution. Significant are wastes from healthcare and veterinary care in group 18 – their production in 2035.
Stabilisation and biodegradation	Production of hazardous waste in 2035 in individual regions.
Processing of Construction and Demolition Waste	Cannot be determined – primarily mobile facilities, linked to major demolition/reconstruction/construction projects.

Source: own processing

In the segment of future management of primarily mixed municipal waste, prepared projects are already known.

From the presented and known plans, it follows that the Eastern region will primarily be oriented towards treatment and mechanical sorting of mixed municipal waste with the aim of producing alternative fuels, linked to existing and planned projects for the transformation of the energy sector towards the use of alternative fuels.

Conversely, according to the known and presented projects, the Western region will be oriented more towards the utilisation of mixed municipal waste within waste-to-energy facilities.

As already stated above, however, each project is individual, and the condition of its implementation depends on a wide range of aspects. **In the field of waste management, a market environment applies, and it is not possible for the state to centrally determine the locations where projects should be implemented.** The individual entities active in the waste market themselves bear the risks associated with securing their clients and waste streams.

Transport costs also have a significant impact on the overall costs of waste management. Naturally, therefore, projects will emerge that take into account local waste generation.

Another important aspect in the development of projects is the suitability of the given location. The construction of waste infrastructure "on greenfield sites" is very difficult and is usually accompanied by resistance from citizens and civic initiatives. Typically, in the case of FERW plants or hazardous waste incinerators, it can be expected that investments will be implemented in locations where infrastructure already exists and will be adapted or expanded. The construction of new projects in completely new locations appears rather unrealistic. Thus, these are investments where the geographical division into NUTS 2 regions is unlikely to be maintained.

In the Czech Republic, a market environment will operate, which by its very nature should optimise the overall costs of waste management.

5.3.2 Sources of Financing and Enforcement of Measures of the WMP CR

Investments in the waste and circular economy of the CR may be financed through the appropriate use of economic instruments, including subsidy programmes (European and national funds) or private investments.

These programmes focus on financing the transition to the principles of the circular economy and on improving the application of the waste management hierarchy, waste prevention, increasing the quality of sorting and improving the usability of sorted waste in line with the priorities and hierarchy of waste management, as well as the creation and expansion of capacities for recycling and waste recovery. Financial incentives favour, and will continue to **favour, support for highly efficient and high-quality recycling and the manufacture of products with recycled content (recyclates).** Subsidy support also focuses on financing **technologies that minimise waste generation, increase recycling and processing of secondary raw materials, innovative technologies, and new approaches to waste recovery.** Research and development and environmental education in the field of waste and circular economy are also supported.

The largest sources of financing for investments in technologies are the European Structural and Investment Funds (ESIF) and the National Recovery Plan (NPO).

For an overview of sources of financing of the waste and circular economy of the CR, see the table.

Table 91: Overview of Sources of Financing for the Development of the Waste and Circular Economy

Operational Programmes
Operational Programme Environment 2021–2027 (OPE)
Operational Programme Technology and Applications for Competitiveness (OPTAK)
Operational Programme Just Transition 2021–2027 (OPJT)
Integrated Regional Operational Programme (IROP)
Other Programmes

National Recovery Plan (NPO)
Modernisation Fund
National Programme Environment (NPE)
Programme Environment for Life and Environment for Life 2
MoT programmes
EEA and Norway Grants
MoA programmes
Programme for the Support of NGO Projects
Directly Managed EU Programmes
Horizon Europe
LIFE
Single Market Programme
Innovation Fund
National and International Cooperation Programmes
Interreg – European Territorial Cooperation Programmes
Interreg Central Europe
Europe Interreg
Other Sources of Financing

Operational Programme Environment 2021–2027 (OPE)

The Operational Programme Environment (OPE) has long been the main subsidy programme supporting the development of the waste and circular economy of the CR. In the programming period 2021–2027, the circular economy is addressed under Specific Objective (SO) 1.5 Support for the Transition to a Resource-Efficient Circular Economy.

SO 1.5 – Support for the Transition to a Resource-Efficient Circular Economy

Within the programme and SO 1.5, the entire area of waste and circular economy is supported. The priority is to support activities leading to the development of waste and circular economy infrastructure, the fulfilment of the objectives of the WMP CR, commitments towards the EU, and the improvement of the application of the waste management hierarchy.

In the area of **waste prevention**, the following activities are supported:

- Acquisition of composters for the prevention of municipal waste generation;
- Development of re-use centres for the re-use of products, including activities for the repair and extension of product lifespan;
- Development of food bank infrastructure;
- Support for the prevention of waste generation from single-use tableware or single-use packaging.
- In the area of waste recovery, the following activities are supported:
- Construction and modernisation of collection yards, systems for separate collection and waste transport;
- Support for sorting and re-sorting systems (including treatment) for the separation of other wastes;

- Development of facilities for the treatment and processing of sewage sludge from wastewater treatment plants;
- Construction and modernisation of facilities for material recovery of waste;
- Construction and modernisation of facilities for energy recovery of waste;
- Development and modernisation of facilities for chemical recycling of waste;
- Development and modernisation of facilities for the collection and management of hazardous waste.

Operational Programme Technology and Applications for Competitiveness 2021–2027 (OPTAK)

The area of the circular economy with a primary focus on business entities is supported by the Ministry of Industry and Trade within OPTAK.

SO 5.2 – Support for the Transition to a Resource-Efficient Circular Economy

Supported activities:

- Acquisition of innovative technologies for the recovery, processing, and utilisation of secondary raw materials from end-of-life products and materials, and for the manufacture of products containing secondary raw materials;
- Support for innovative technologies for the recovery and processing of secondary raw materials (e.g. by-products, non-waste materials, non-conforming products, and others);
- Investments in innovative technologies enabling new or higher utilisation of secondary raw materials as substitutes for primary resources;
- Investment in innovative technologies to reduce the material intensity of production and to replace primary input raw materials with secondary raw materials;
- Optimisation of the material eco-design of products in order to facilitate recycling and reuse;
- Projects and implementation of industrial symbiosis;
- Improvement of material recycling of waste and its re-use;
- Emphasis on the re-closing of material cycles, particularly through the support of material recycling;
- Introduction of product material eco-design (support for innovative production technologies applying remanufacturing).

Operational Programme Just Transition 2021–2027 (OPJT)

The OPJT addresses the negative impacts of the coal phase-out in the most affected regions of the CR, namely Karlovy Vary, Ústí nad Labem and Moravian-Silesian Regions. In the field of the circular economy, innovative projects aimed at sorting, re-sorting, treatment, material transformation, and chemical recycling of other and hazardous wastes are supported.

National Recovery Plan (NPO)

Component 2.7 Circular Economy, Recycling, and Industrial Water

Within Activity 2.7.1.1 Development of Recycling Infrastructure, support is provided for the increase in capacity and efficiency of the system of BDW management as a whole, primarily through the support of facilities for the treatment of biodegradable waste and the application and incorporation of compost produced from BDW treatment facilities into agricultural land.

Modernisation Fund

The Modernisation Fund is an instrument financed from revenues from the sale of emission allowances, with its main objective being the modernisation of the energy sector. The Modernisation Fund is divided into separate priority programmes, within which funds are also allocated to support selected types of facilities for energy recovery of waste and the construction of biogas plants.

Programme No. 2 Modernisation of District Heating Systems (HEAT)

Within the HEAT programme, projects for the reconstruction or replacement of a heat source in district heating systems with a change in fuel base or type of energy to waste-to-energy in combination with high-efficiency CHP can be supported.

Programme No. 5 Renewable Gaseous and Liquid Fuels (GREENGAS)

Within this programme, projects for the construction of waste and municipal biogas plants and facilities for upgrading biogas to biomethane can be supported.

Programme No. 7 Community Energy (KOMUNERG)

Within this programme, projects for the construction of community biogas plants processing community-sorted BDW, generated industrial BDW, sewage sludge from wastewater treatment plants, or agricultural by-products can be supported.

National Programme of the Environment (NPE),

The priority of the area **"Waste, Old Burdens and Environmental Risks"** is investments focused on waste prevention, compliance with the waste management hierarchy, and minimisation of the impact of waste on human health and the environment.

The aim of this priority area is:

- Compliance with the waste management hierarchy.
- Prevention of waste generation and reduction of specific waste generation.
- Maximum recovery of waste as a substitute for primary resources.
- Minimisation of the adverse effects of waste generation and waste management on human health and the environment.
- Minimisation of environmental risks (old landfills, old environmental burdens, chemical substance management, prevention of industrial accidents).
- Sustainable development of society and the transition towards a "circular economy."

Programme Environment for Life and the Follow-Up Programme Environment for Life 2

A programme of the Ministry of the Environment to support applied research and innovation in the field of environmental protection, climate protection, and sustainable development. Within the programme, research projects leading to the transition to a circular economy, the efficient use of natural resources and long-term sustainability can be supported.

Other Sources of Financing

The operation of waste management and possible compensation for increased costs is further financed through the use of economic instruments set out in Chap. 4.2.2.

Programme for the Support of NGO Projects

This programme has long focused on supporting projects in education, training, and awareness-raising in the field of waste prevention, minimisation of waste generation, waste recovery, and the transition to a circular economy.

Extended Producer Responsibility (EPR) Systems

Another source of financing for waste management is the costs associated with the operation of systems ensuring extended producer responsibility; this concept is described in more detail in Chap. 4.2.2.

Public Procurement

The new methodology of public procurement supports the circular economy in the Czech Republic. For more detail, see Chap. 4. 2. 2.

Private Investments

Private investments may be prompted by the need to expand the separate collection network or the need to build or modernise other technologies. Impulses for private investment include, for example, the stability of the environment, market potential and the estimated capacity gap of the collection network and waste management facilities, see the conclusions of the economic analysis. Another financing option may also be projects under public–private partnerships (PPP).

5.4 Risk Assessment

5.4.1 Macroeconomic Level

One of the objectives of this study is to evaluate the impacts of fulfilling the WMP CR on the economy of the Czech Republic. The key factors that may influence the stated estimates of economic consequences are macroeconomic aggregates and their development over the horizon to 2035 (in particular GDP, the consumer price index, the industrial production index, etc.).

Another significant factor comprises changes in statutory charges and taxes that affect the price of waste management (fees, VAT, excise duty, personal income tax as well as corporate income tax, etc.). The outputs are likewise significantly dependent on price developments in the market for secondary raw materials—in the event of a significant market slump, higher impacts on individual entities in the economy may be expected and the costs/revenue ratio may deteriorate. It is also important to take into account the experience from COVID-19 and the economic downturn in the context of restrictions arising from business closures.

Furthermore, the estimates of investment costs (specific) are based on an expert market and literature review from 2023 and may in reality differ depending on the development of the economic environment.

For the development of waste management and the circular economy, demand for the secondary raw materials and fuels produced is absolutely crucial. This is directly dependent on the development of industry. In the event of a decline in production, both in industry and construction, and thus a reduction in demand for raw materials, an imbalance may arise between demand for, and supply of secondary raw materials or fuels produced from waste. However, waste management must process waste continuously. Longer-term shortfalls in off-take of secondary raw materials produced may have negative consequences for meeting the targets for recycling and recovery of waste.

Last but not least, a fresh experience is the war in Ukraine. However, these circumstances and their recurrence are entirely unpredictable. With regard to international relations and the risk of a global military conflict, one can indeed observe a rising probability, but it is not possible to anticipate specific impacts and their realism. Were a global conflict genuinely to occur, then all scenarios of future development would overnight lose their relevance.

Macroeconomic factors also include monetary policy, which will influence market prices of products traded globally, or at least within the European continent. Another macroeconomic factor is the stability of markets, trade wars, tariffs, and sanctions. Particularly at the time of preparation of this study, the influence of protectionism in certain areas vis-à-vis China can be observed. Sanctions against the Russian Federation likewise exist. These measures do not currently threaten waste management; however, further measures could. It will be important, for example, to monitor the possibilities for the export of textile waste and textiles to African countries. A potential ban could be comparable to the impact of the ban on the import of selected plastic waste into China and other countries after 2016.

Last but not least, a risk that is manifest at the time of preparation of this study is unemployment, or rather a shortage of labour. On the other hand, this may induce investments in automation and the development of advanced technologies.

The analysis does not work with unpredictable factors such as future technological innovations, potential future, and as yet unknown legislation, since such influences cannot be predicted.

At the macroeconomic level, the risks therefore consist in particular of the following

- development of macroeconomic indicators,
- changes caused by statutory charges and taxes,
- price developments in the market for secondary raw materials,
- crises in the economy (economic crises, armed conflicts, global pandemics),
- technological changes and innovations.

Proposals for the elimination of risks at the macroeconomic level

- for endogenous factors that can be influenced by fiscal and monetary policy, transparent communication by the institutions concerned (the Czech National Bank (CNB), the Government of the CR) is necessary,
- the creation by state institutions of a stable and transparent environment to the maximum extent possible (the need for trust and realistic expectations),
- for exogenous factors there is limited scope for influence and reaction; it is necessary to monitor changes in macroeconomic aggregates and respond to them sensitively.

5.4.2 Macroeconomic Level

Among the factors at the microeconomic level that may affect the explanatory power of the outputs of the analysis are, for example, changes in household budget expenditures (shifts between different consumption expenditures). A fall in disposable income or increasing household expenditures on certain goods and services of basic necessity, may jeopardise the willingness to pay for activities provided by municipalities to households. Since meeting the requirements of the WMP CR will in many cases mean the adoption of new regulations, a significant factor (outside the economic evaluation within this study) is also residents' aversion to the construction of new waste-management facilities.

At the microeconomic level, the risks therefore consist in particular of the following

- changes in household budget expenditures (changes in consumer behaviour, the level of disposable income, etc.),
- residents' aversion to the construction of new waste-management facilities (the NIMBY effect).

Proposals for the elimination of risks at the microeconomic level

- exogenous factors can be influenced indirectly, e.g. by reducing/increasing payments for municipal waste at the level of municipalities and other charges in waste management,
- the need to find a balance between the reduction of disposable income and household consumption and the desired state of waste management,
- transparent communication and the involvement of stakeholders in the process to reverse the so-called NIMBY effect (open communication about the intention, listening to residents' concerns, investment in infrastructure, financial compensation, the creation of new jobs, participation in further development, etc.).

5.4.3 Other Risks

Climate Change

Risks in the 2020s and 2030s of the 21st century will also be posed by climate change. In the Czech Republic, from approximately the middle of the previous decade, dry periods have become more frequent and more pronounced. Higher temperatures are also manifest. This is also associated with opposite extremes – short and intense rainfall events leading to sudden flash floods or landslides. These climatic phenomena may directly and indirectly endanger waste management and the operation of individual technologies. The environmental impact differs according to the type of climatic phenomenon and the technology affected.

Floods and tornadoes will have an effect on the generation of waste and the need for its disposal. Contamination of waste-management technologies and waste storage areas at such facilities may also occur.

Drought may increase fire risks and create waste in the form of debris, which will have to be disposed of somewhere, or, in a better case, further recovered.

All the risks described can be mitigated to a certain extent. This includes, for example, the siting of technologies and their securing. Also plans for responses to natural disasters, and the like. Nevertheless, these risks cannot be completely prevented.

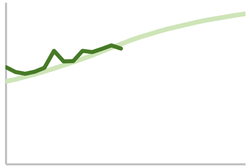
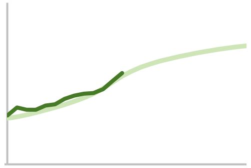
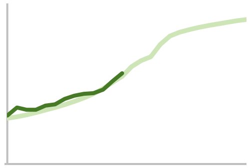
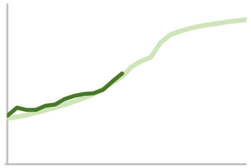
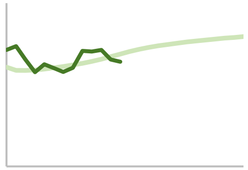
Political and Legislative Changes

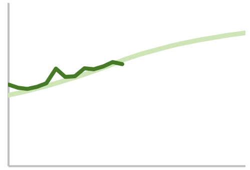
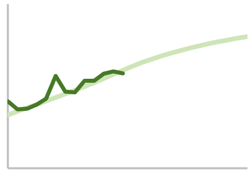
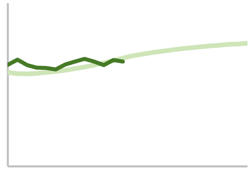
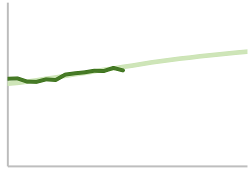
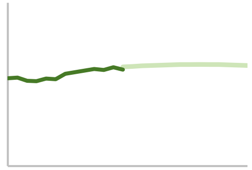
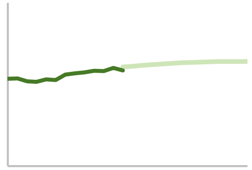
To meet the objectives of waste management, a stable legal environment with clearly defined medium-term and long-term goals will be necessary. Frequent updates and, above all, systemic changes may trigger nervousness and the suspension of the investments necessary to meet the objectives. Effective changes, by contrast, may significantly support investments and accelerate the transition to a circular economy.

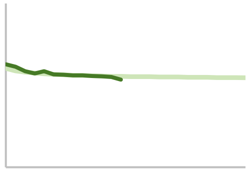
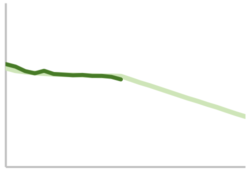
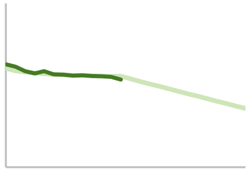
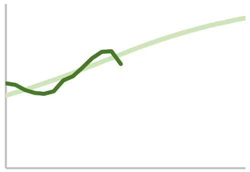
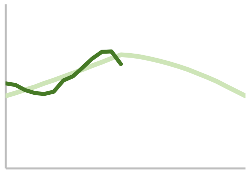
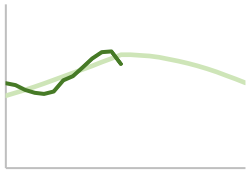
5.5 Forecast of Trends in Waste Management

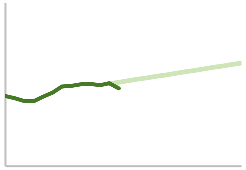
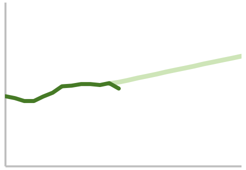
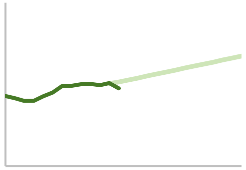
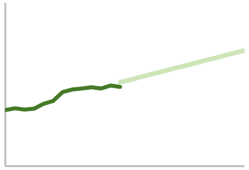
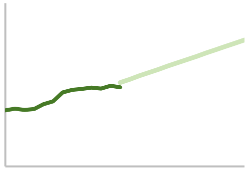
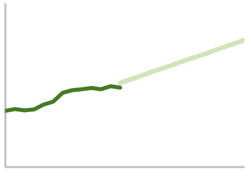
To meet European objectives, it will be necessary to adapt waste management. The WMP CR sets out scenarios for meeting the objectives. Projections were created for these purposes. Trends for individual streams and for total generation are presented in the following table.

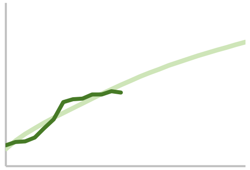
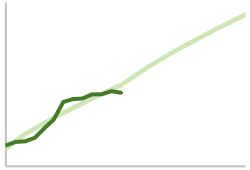
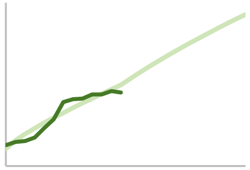
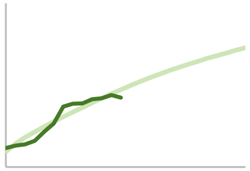
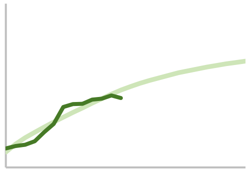
Table 92: Current Generation and Expected Development until 2035 by Waste Streams

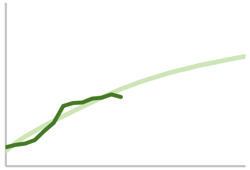
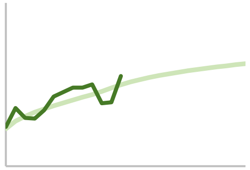
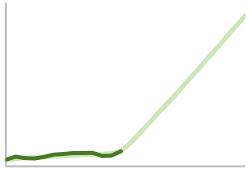
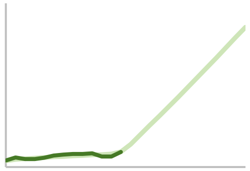
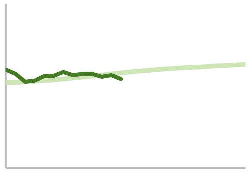
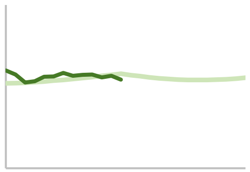
Waste stream	Waste included in groups	2022 [thous. t]	2030 [thous. t]	2035 [thous. t]	Development	Note on expected development
Primary waste (primary generation)	all groups	35,982	Forecast: 44,044	Forecast: 46,576		Long-term slightly increasing trend. The fluctuation in 2015 is mainly due to Group 17, otherwise generation follows the long-term trend apart from isolated minor fluctuations. Further significant growth is expected in the future.
Secondary waste (secondary generation)	16 , 19	3,391	Forecast: 4,083	Forecast: 4,338		Secondary waste has been growing for a long time. A significant upswing came in 2021 and 2022. This increase is also respected in the future forecast, but the growth rate declines from around 2025 onwards.
			Trajectory 1: 5,100	Trajectory 1: 5,398		Optimistic scenario. It is expected that there will be higher energy recovery of waste, accompanied by the construction of facilities for energy recovery of waste and facilities for machine sorting recyclable and recoverable fractions from mixed municipal waste, followed by the production of solid alternative fuels. There will also be increased sorting of material-recoverable fractions. These changes will lead to a significant increase in the generation of secondary waste.
			Trajectory 2: 5,146	Trajectory 2: 5,400		Realistic scenario. The same factors as in the optimistic scenario apply; however, due to the lower number of inhabitants who actively sort waste, the development of waste generation will differ slightly. In 2035, however, a more or less identical level of waste generation is expected under both scenarios.
Hazardous Waste	all groups	1,604	1,845	1,918		The generation of hazardous waste fluctuates year-on-year, rather in waves. In 2021 and 2022, generation declined; in the future, a slight increase in the generation of hazardous waste is expected.

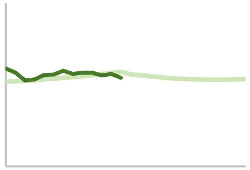
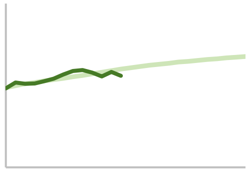
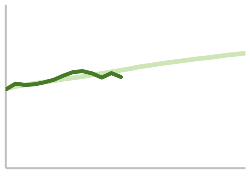
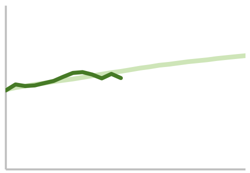
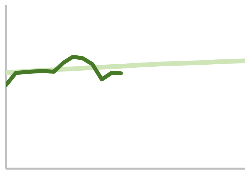
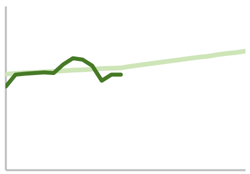
Waste stream	Waste included in groups	2022 [thous. t]	2030 [thous. t]	2035 [thous. t]	Development	Note on expected development
Other waste	all groups	37,555	46,282	48,996		Apart from occasional fluctuations to higher figures, the generation of other waste has been increasing in the long term and follows the trend. Further growth in the generation of other waste is expected, with the growth rate expected to slow slightly around 2030.
Mineral Waste	01, 02, 05, 06, 08, 10, 11, 12, 15, 16, 17, 19, 20	23,099	29,833	32,059		In 2015 there was a significant deviation from the trend towards higher generation; otherwise, generation follows a markedly increasing trend, which is also expected in the future unless further unexpected fluctuations occur that would affect the long-term trend. The main influence on generation is in subgroup 17 05.
Generation excluding Mineral Waste	all groups	16,061	18,293	18,858		In the long term, the trend is rather constant, with slight fluctuations. Given the expected significant increase in the generation of all waste, a slight increase is also anticipated in this stream (apart from the pronounced increase in the generation of mineral waste).
Municipal Waste	20	5,854	Forecast: 6,850	Forecast: 7,142		A long-term slightly increasing trend without significant fluctuations, expected to continue according to the forecast. Approximately 75% of citizens sort municipal waste, yet it has not been possible to fully apply waste prevention, and generation is increasing.
			Trajectory 1: 6,224	Trajectory 1: 6,165		Optimistic scenario. It is expected that approximately 86% of citizens sorts municipal waste intensively. By 2030, growth will slow down, and from 2031 onwards a slight decline in generation is anticipated.
			Trajectory 2: 6,369	Trajectory 2: 6,410		Realistic scenario. It is expected that approximately 81% of citizens sorts municipal waste intensively. There is a slowdown in the growth of generation, but growth will not be fully halted. Generation will increase slightly by 2035.

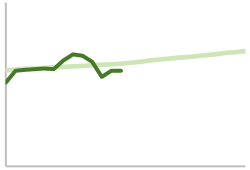
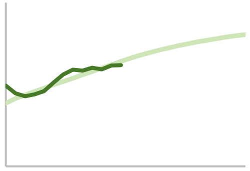
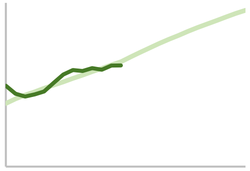
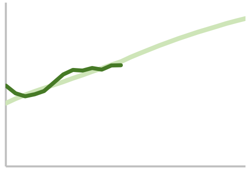
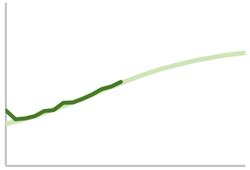
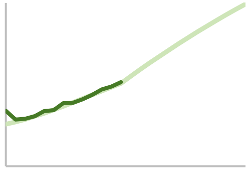
Waste stream	Waste included in groups	2022 [thous. t]	2030 [thous. t]	2035 [thous. t]	Development	Note on expected development
Mixed Municipal Waste	20	2,675	Forecast: 2,748	Forecast: 2,733		Generation has been slightly declining in the long term, following the trend with occasional fluctuations such as in 2014 (upwards) and in 2022, when a decline occurred again. According to the forecast, a continued slight decline is expected, though development according to the scenarios below is more likely.
			Trajectory 1: 2,009	Trajectory 1: 1,539		Optimistic scenario. Prevention of waste generation will work very effectively, and most material-recoverable fractions will not enter mixed municipal waste, which will lead to a significant decline in its generation.
			Trajectory 2: 2,168	Trajectory 2: 1,796		Realistic scenario. The diversion of material-recoverable fractions from mixed municipal waste will also take place, but not to the same extent as in the optimistic scenario. Here, too, the effect of waste prevention is considered, and a significant decline in mixed municipal waste generation is predicted.
Bulky Waste	20	635	Forecast: 849	Forecast: 914		Generation has been growing significantly since 2015. In 2021, stagnation occurred, and in 2022 a more pronounced decline. According to the forecast, a significant increase in generation is expected in the following years. However, development is expected to follow the prediction – the scenarios below.
			Trajectory 1: 579	Trajectory 1: 441		Optimistic scenario. A significant decline in generation is assumed. In addition to the effect of municipal waste prevention, the re-sorting of approximately 70% of bulky waste by citizens and at civic amenity sites works very effectively.
			Trajectory 2: 624	Trajectory 2: 520		Realistic scenario. Here, too, a significant decline in generation is assumed. In addition to the effect of municipal waste prevention, the re-sorting of approximately 60% of bulky waste at civic amenity sites works very effectively.

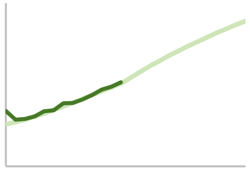
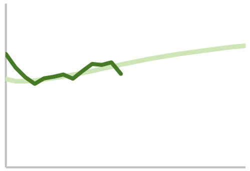
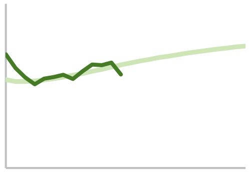
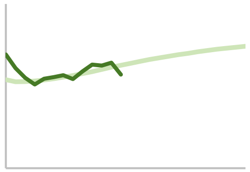
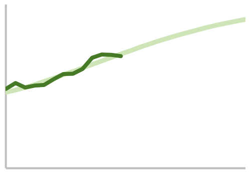
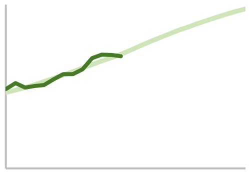
Waste stream	Waste included in groups	2022 [thous. t]	2030 [thous. t]	2035 [thous. t]	Development	Note on expected development
Biodegradable waste	02, 03, 04, 15, 16, 17, 19, 20	4,273	Forecast: 4,692	Forecast: 5,052		In 2022, there was a more pronounced decline in generation. In the long term, however, the continuation of the previous long-term growth in waste generation is expected.
			Trajectory 1: 4,899	Trajectory 1: 5,383		Optimistic scenario. A partial decline in the generation of cat. no. 20 02 01, for example due to restrictions on grass mowing, and a significant increase in the generation of cat. no. 20 01 08 in view of the expected development of separate collection of kitchen waste.
			Trajectory 2: 4,900	Trajectory 2: 5,388		Realistic scenario. The same factors as in the optimistic scenario apply; however, the decrease under category No. 20 02 01 and the increase under category No. 20 01 08 will not be as pronounced.
Biodegradable municipal waste	20	2,442	Forecast: 3,167	Forecast: 3,542		As a result of the coefficients reflecting the share of the biodegradable component in certain waste streams, growth halted in 2017, followed by a gradual decline from 2018 and a more pronounced decrease in waste generation, particularly in 2020. In the long term, however, the continuation of the previous long-term growth in waste generation is expected.
			Trajectory 1: 3,375	Trajectory 1: 3,873		Optimistic scenario. A partial decline in the generation of cat. no. 20 02 01, for example due to restrictions on grass mowing, and a significant increase in the generation of cat. no. 20 01 08 in view of the expected development of separate collection of kitchen waste.
			Trajectory 2: 3,376	Trajectory 2: 3,877		Realistic scenario. The same factors as in the optimistic scenario apply; however, the decrease under category No. 20 02 01 and the increase under category No. 20 01 08 will not be as pronounced.

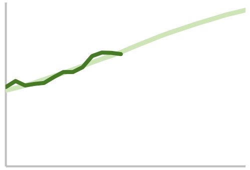
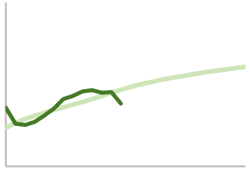
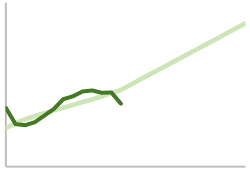
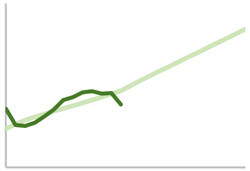
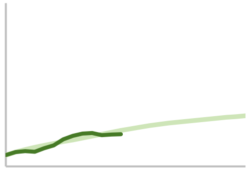
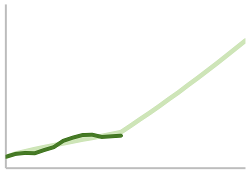
Waste stream	Waste included in groups	2022 [thous. t]	2030 [thous. t]	2035 [thous. t]	Development	Note on expected development
Biodegradable Waste	20	901	Forecast: 1,350	Forecast: 1,520		A sharp increase between 2013 and 2016, followed by slight growth. In the long term, further larger growth in generation is expected.
			Trajectory 1: 1,558	Trajectory 1: 1,852		Optimistic scenario. A partial decline in the generation of cat. no. 20 02 01, for example due to restrictions on grass mowing, and a significant increase in the generation of cat. no. 20 01 08 in view of the expected development of separate collection of kitchen waste.
			Trajectory 2: 1,558	Trajectory 2: 1,856		Realistic scenario. The same factors as in the optimistic scenario apply; however, the decrease under category No. 20 02 01 and the increase under category No. 20 01 08 will not be as pronounced.
Biodegradable waste from gardens and parks	20	846	Forecast: 1,291	Forecast: 1,458		This stream constitutes the largest fraction of biodegradable waste and therefore mirrors its development. A sharp increase between 2013 and 2016, followed by slight growth. In the long term, further larger growth in generation is expected.
			Trajectory 1: 1,204	Trajectory 1: 1,298		Optimistic scenario. A partial decline in the generation of cat. no. 20 02 01, for example due to restrictions on grass mowing. Furthermore, a shift to community composting of plant residues in municipalities is expected, as this may be counted towards meeting recycling targets. At the same time, a shift towards more environmentally conscious behaviour of citizens and greater prevention, e.g. through the use of home composting, is also anticipated.

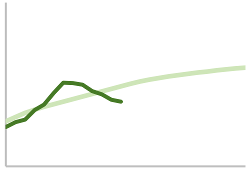
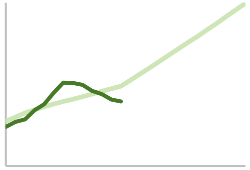
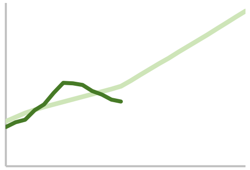
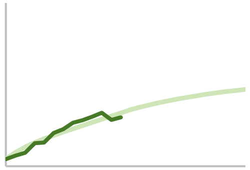
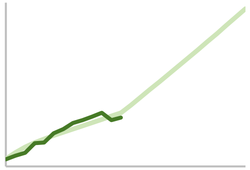
Waste stream	Waste included in groups	2022 [thous. t]	2030 [thous. t]	2035 [thous. t]	Development	Note on expected development
			Trajectory 2: 1,229	Trajectory 2: 1,344		Realistic scenario. The same factors as in the optimistic scenario apply; however, the decrease will not be as pronounced.
Animal By-products and Biodegradable Waste from Kitchens and Catering Establishments	20	55	Forecast: 59	Forecast: 63		A long-term increasing trend with slight fluctuations in generation and a decline in 2020 and 2021 due to the COVID-19 pandemic. The increasing trend is expected to continue in the future.
			Trajectory 1: 354	Trajectory 1: 553		Optimistic scenario. The development of separate collection of kitchen waste and the discontinuation of inappropriate food waste management are expected. A significant increase in generation is anticipated.
			Trajectory 2: 329	Trajectory 2: 512		Realistic scenario. The development of separate collection of kitchen waste and the discontinuation of inappropriate food waste management are expected. A slowdown and lower growth can be expected as a result of initiatives to prevent or reduce food waste. A significant increase in generation is anticipated.
Food Waste	02, 16, 20	1,081	Forecast: 1,230	Forecast: 1,261		The generation of food waste is fluctuating; it increased between 2012 and 2016, then has been slowly declining. In the future, a slightly increasing trend in generation is expected.
			Trajectory 1: 1,082	Trajectory 1: 1,107		Optimistic scenario. Depending on the municipal waste generation scenarios, changes will also occur in the generation of food waste. As a result of waste prevention measures, the amount of food waste in mixed municipal waste will decrease. A decrease in generation is expected.

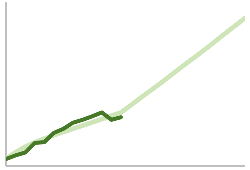
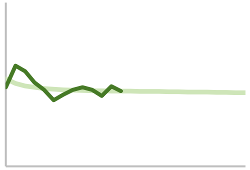
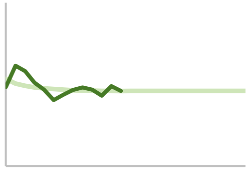
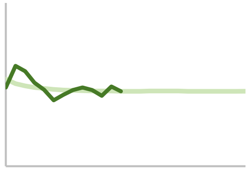
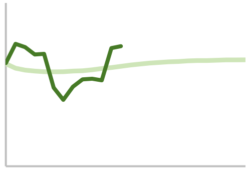
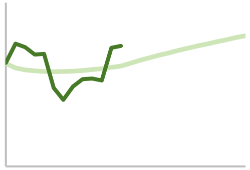
Waste stream	Waste included in groups	2022 [thous. t]	2030 [thous. t]	2035 [thous. t]	Development	Note on expected development
			Trajectory 2: 1,064	Trajectory 2: 1,070		Realistic scenario. The same reasons as in the optimistic scenario, only to a lesser extent. In the future, a decline in generation is expected.
All paper	03, 15, 20	1,118	Forecast: 1,306	Forecast: 1,354		A long-term stable increase with slight fluctuations, which is also expected in the future.
			Trajectory 1: 1,339	Trajectory 1: 1,408		Optimistic scenario. The replacement of printed matter with digital formats, which will lead to a decline in generation. Counteracting this, however, is the development of e-commerce and parcel services, where paper packaging is extensively used and is expected to be used even more in the future. In the future, an increase in generation is anticipated.
			Trajectory 2: 1,328	Trajectory 2: 1,389		Realistic scenario. The same reasons as in the optimistic scenario, only to a lesser extent. In the future, an increase in generation is anticipated.
Separated paper	15 , 20	466	Forecast: 518	Forecast: 527		Long-term slightly increasing trend. In 2016 and 2017, a sharp increase occurred, followed by a decline until 2020. In the future, the increasing trend is expected to continue.
			Trajectory 1: 551	Trajectory 1: 582		Optimistic scenario. The replacement of printed matter with digital formats, which will lead to a decline. Counteracting this, however, is the development of e-commerce and parcel services, where paper packaging is extensively used and is expected to be used even more in the future. In the future, an increase in generation is anticipated.

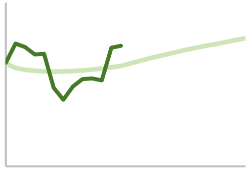
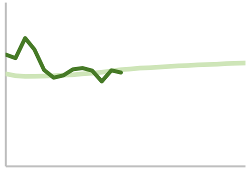
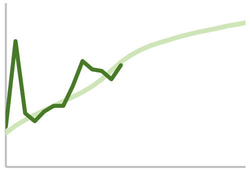
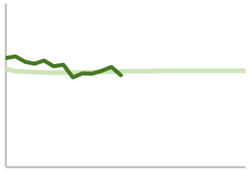
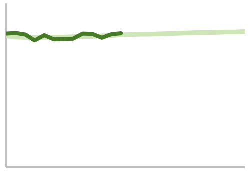
Waste stream	Waste included in groups	2022 [thous. t]	2030 [thous. t]	2035 [thous. t]	Development	Note on expected development
			Trajectory 2: 539	Trajectory 2: 563		Realistic scenario. The same reasons as in the optimistic scenario, only to a lesser extent. In the future, an increase in generation is anticipated.
All plastics	02, 07, 12, 15, 16, 17, 20	494	Forecast: 609	Forecast: 644		After a decline until 2012, growth continued until 2017, when stagnation occurred, or rather the beginning of slight growth. In the future, a more pronounced increase is expected.
			Trajectory 1: 679	Trajectory 1: 764		Optimistic scenario. As with paper, the development of e-commerce and parcel services, where plastic packaging is often used, leads to increased generation. Further, more sorting of plastic waste and its transfer from mixed municipal waste to separated waste is expected. In the future, a more pronounced increase in generation is anticipated.
			Trajectory 2: 655	Trajectory 2: 722		Realistic scenario. The same reasons as in the optimistic scenario, only to a lesser extent. In the future, a more pronounced increase in generation is anticipated.
Separated plastic	15 , 20	206	Forecast: 259	Forecast: 277		Until 2012, a slight decline, followed by the onset of stable growth, which is expected to continue.
			Trajectory 1: 330	Trajectory 1: 397		Optimistic scenario. As with paper, the development of e-commerce and parcel services, where plastic packaging is often used, leads to increased generation. Further, more sorting of plastic waste and its transfer from mixed municipal waste to separated waste is expected. In the future, a more pronounced increase in generation is anticipated.

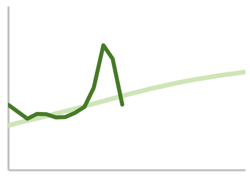
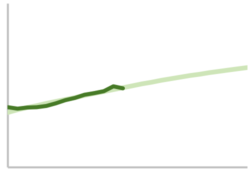
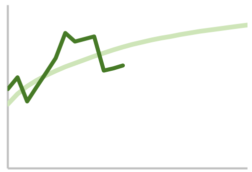
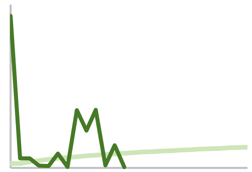
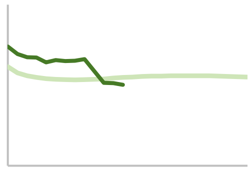
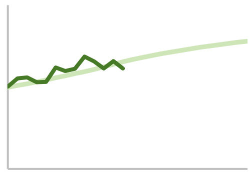
Waste stream	Waste included in groups	2022 [thous. t]	2030 [thous. t]	2035 [thous. t]	Development	Note on expected development
			Trajectory 2: 306	Trajectory 2: 356		Realistic scenario. The same reasons as in the optimistic scenario, only to a lesser extent. In the future, a more pronounced increase in generation is anticipated.
All glass	10, 15, 16, 17, 20	285	Forecast: 354	Forecast: 371		Until 2013, a significant decline, followed by slight growth with several fluctuations. In the future, the increasing trend is expected to continue.
			Trajectory 1: 364	Trajectory 1: 387		Optimistic scenario. A shift of glass from mixed municipal waste to separated waste is expected due to prevention and increased sorting in households as well as in businesses. The growth trend is expected to continue.
			Trajectory 2: 361	Trajectory 2: 382		Realistic scenario. The same reasons as in the optimistic scenario, only to a lesser extent. In the future, an increase in generation is anticipated.
Separated glass	15 , 20	171	Forecast: 211	Forecast: 227		Long-term stable growth, stagnation to slight decline since 2021. In the future, growth is expected to continue.
			Trajectory 1: 221	Trajectory 1: 243		Optimistic scenario. A shift of glass from mixed municipal waste to separated waste is expected due to prevention and increased sorting in households as well as in businesses. In the future, an increase in generation is anticipated.

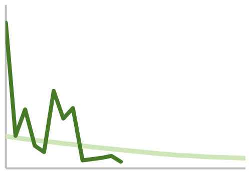
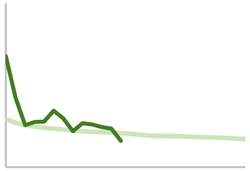
Waste stream	Waste included in groups	2022 [thous. t]	2030 [thous. t]	2035 [thous. t]	Development	Note on expected development
			Trajectory 2: 218	Trajectory 2: 238		Realistic scenario. The same reasons as in the optimistic scenario, only to a lesser extent. In the future, an increase in generation is anticipated.
All wood	02, 03, 15, 17, 20	269	Forecast: 397	Forecast: 425		Until 2011, a sharp decline, followed by significant growth, which shifted into stagnation and even a slight decline in 2020. In 2022, a sharp decrease occurred. In the future, the generation of wood is expected to increase.
			Trajectory 1: 503	Trajectory 1: 613		Optimistic scenario. Extensive re-sorting of bulky waste will lead to a significant increase in the generation of wood. A slowdown may occur due to efforts to introduce furniture designed according to circular and sustainable principles with a longer lifespan; however, the effect is estimated to be seen only around 2035.
			Trajectory 2: 491	Trajectory 2: 591		Realistic scenario. The same reasons as in the optimistic scenario, only to a lesser extent. In the future, an increase in generation is anticipated.
Separated wood	20	79	Forecast: 114	Forecast: 124		Long-term increasing generation with slight fluctuations, and growth is expected to continue in the future.
			Trajectory 1: 220	Trajectory 1: 312		Optimistic scenario. Extensive re-sorting of bulky waste will lead to a significant increase in generation. A slowdown may occur due to efforts to introduce furniture designed according to circular and sustainable principles with a longer lifespan; however, the effect is estimated to be seen only around 2035.

Waste stream	Waste included in groups	2022 [thous. t]	2030 [thous. t]	2035 [thous. t]	Development	Note on expected development
			Trajectory 2: 208	Trajectory 2: 290		Realistic scenario. The same reasons as in the optimistic scenario, only to a lesser extent. In the future, an increase in generation is anticipated.
Textile waste total	04, 15, 20	59	Forecast: 86	Forecast: 90		Increase until 2016, then decrease. Given the historical production, it is difficult to predict the development, but future growth is expected in any case.
			Trajectory 1: 119	Trajectory 1: 150		Optimistic scenario. There is a significant increase in textile waste, primarily due to the obligation of municipalities, as of 2025, to introduce separate collection of textile waste. The increase will also be influenced by the further sorting of bulky waste or the transfer of textile waste from mixed municipal waste.
			Trajectory 2: 115	Trajectory 2: 142		Realistic scenario. The same reasons as in the optimistic scenario, only to a lesser extent. In the future, an increase in generation is anticipated.
Separated textiles	20	36	Forecast: 52	Forecast: 56		A long-term stable increase with a decline only in 2021, probably due to the Covid-19 pandemic. Subsequently, growth continued, which is also expected in the future.
			Trajectory 1: 85	Trajectory 1: 116		Optimistic scenario. There is a significant increase in textile waste, primarily due to the obligation of municipalities, as of 2025, to introduce separate collection of textile waste. The increase will also be influenced by the further sorting of bulky waste or the transfer of textile waste from mixed municipal waste.

Waste stream	Waste included in groups	2022 [thous. t]	2030 [thous. t]	2035 [thous. t]	Development	Note on expected development
			Trajectory 2: 81	Trajectory 2: 109		Realistic scenario. The same reasons as in the optimistic scenario, only to a lesser extent. In the future, an increase in generation is anticipated.
Ferrous Metals	02, 10, 12, 15, 16, 17, 20	3,674	Forecast: 3,629	Forecast: 3,597		A sharp increase in 2011, followed by a significant decline until 2015, then a fluctuating trend. A slight decrease or stagnation is expected. The future development will be determined by ferrous metal waste (steel scrap) from other holders (companies).
			Trajectory 1: 3,682	Trajectory 1: 3,684		Optimistic scenario. Within total ferrous waste, only a slight increase is expected, reflecting more extensive sorting of metal waste in households and businesses and the additional sorting of bulky waste.
			Trajectory 2: 3,677	Trajectory 2: 3,674		Realistic scenario. The same reasons as in the optimistic scenario, only to a lesser extent.
Separated metals	15 , 20	442	Forecast: 388	Forecast: 391		Fluctuating generation, with a steep decline in 2015 and 2016, followed by growth and a sharp increase in 2021. In the future, a rather constant development is expected; however, due to the fluctuating generation, it is difficult to predict.
			Trajectory 1: 441	Trajectory 1: 479		Optimistic scenario. An increase is expected owing to greater sorting of metal waste in households and companies, and the further sorting of bulky waste. The growing popularity of aluminium packaging, for example in the food industry, may also contribute to the increase.

Waste stream	Waste included in groups	2022 [thous. t]	2030 [thous. t]	2035 [thous. t]	Development	Note on expected development
			Trajectory 2: 435	Trajectory 2: 469		Realistic scenario. The same reasons as in the optimistic scenario, only to a lesser extent. In the future, an increase in generation is anticipated.
Non-ferrous metals	06, 10, 11, 12, 16, 17	229	248	252		Between 2012 and 2015, there was a significant decline, after which generation rather stagnated. In the future, a slight increase in generation is expected.
Edible oil and grease	20	12	16	18		In 2011, there was a sudden rise, followed by a decline to previous levels and the start of growth. Generation may be considerably higher given that part of the waste also ends up in sewers, and proper management of this waste will take place. An increase is expected due to the introduction and development of separate collection.
Sewage Sludge	02, 03, 19	169	177	176		Long-term slightly declining generation, which is expected to stabilise in the future and stagnate. The entire stream is primarily influenced by sludge code 19 08 05 from the treatment of municipal wastewater, which has long exhibited stable generation levels. Sludge from agriculture and the wood-processing industry shows a declining trend in generation.
Sludge from the treatment of municipal wastewater. And the timber industry have declining production.	19	163	164	166		Generation is long-term constant, which is expected to continue. Alternatively, only a minimal increase of a few per cent may occur due to the construction of wastewater treatment plants even in smaller municipalities.

Waste stream	Waste included in groups	2022 [thous. t]	2030 [thous. t]	2035 [thous. t]	Development	Note on expected development
Asbestos waste	06, 10, 16, 17	36	50	54		Since 2017, there has been a very significant increase in generation, peaking in 2022, followed by a sharp decline. The main stream consists of group 17, therefore the development of generation will be determined by the number of demolitions of older buildings and structures whose construction materials contain asbestos.
Waste from human and veterinary health care	18	48	57	61		Generation has been increasing in the long term and follows the trend. The same development is also expected in the future. Generation consists mainly of sub-group 18 01 (waste from human health care).
Waste Oils	12, 13, 20	32	42	44		The development of generation is abrupt. From 2013 to 2016 it increased sharply, then stagnated, and in 2020 there was a sudden decrease. Long-term development is expected to be increasing, but with the transition to electromobility, a gradual decline is anticipated.
PCB	13, 16, 17	0.14	0.34	0.38		Generation is irregular. A sharp decline after 2010, a sudden increase in 2017 and 2019, and a sudden decrease in 2020. The forecast for the future shows a very slight increase. However, it is more likely that the decline from 2020 and 2022 will continue, and the future trend will shift to a slight decrease.
Industrial waste	03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14	2,513	2,793	2,756		A slightly decreasing trend was disrupted by a sudden decline in 2019 and 2020. Subsequently, a slight decrease continued, which is expected to persist. The main share consists of group 10 and 12.
Construction and Demolition Waste	17	9,201	11,132	11,694		Generation depends on construction and demolition works; therefore, it is slightly fluctuating. In the long term, however, it shows a growing trend. Expected selective demolitions will have a negligible effect on reducing generation; rather, they will redirect waste

Waste stream	Waste included in groups	2022 [thous. t]	2030 [thous. t]	2035 [thous. t]	Development	Note on expected development
						into other waste types. Generation will therefore grow according to the expected trend.
Mining Waste	01 , 17	81	147	124		Generation is highly fluctuating, mainly due to group 17 (excavated gangue and spoil), which constitutes the main share and is linked to construction activities. Waste from treatment shows a slight decrease, but stabilisation at constant generation is expected. Waste from mining has a declining trend, which, however, may change abruptly with the opening of a new mining site. During the construction of infrastructure networks, for example the excavation of large tunnels that are planned, waste generation will increase sharply.
Agricultural waste	02	80	92	85		Long-term decline in generation with slight fluctuations, a sharp decrease until 2012. In the future, a continued decline in generation is expected.

Source: processed on the basis of WMIS and Tiramiso

In addition to the development of individual streams, an extension of EPR systems to further commodities or products is also expected. At the time of preparation of this document, the legislative process for the introduction of mandatory deposit-return for PET bottles and beverage cans is under way. A new version of the Packaging Regulation and the obligations arising therefrom is likewise expected. Development of PAYT systems is anticipated. The intensification of the separate collection network will depend on the prepared new deposit-return system. With the development of mechanical sorting, an expansion of multi-commodity collection can be expected. At the time of preparation of this study, several facilities for energy recovery of waste (FERW) are in preparation. It can be expected that these facilities will be built by 2030. The proportion of waste recovered for energy will thus increase, and at the same time there will be a reduction in the quantity of landfilled municipal waste.

The future extension of the emissions allowance trading system to other sectors will have an impact on waste management and may result in higher costs of waste management.

5.6 Recommendations in Relation to the Economic Aspects of Implementing the Priorities, Objectives, Principles and Measures of the WMP 2025–2035

The key recommendation in relation to the economic aspects of the Waste Management Plan of the Czech Republic for the period 2025–2035 (WMP CR) is adherence to the principles and measures of the WMP CR, and adherence to the principles and measures in the areas of waste prevention, individual waste streams, and other specific areas of waste management. Another important recommendation is to base decisions in the areas of waste management on the Economic Analysis, which was prepared on the basis of a large volume of waste-management data for the Czech Republic. Only in this way is it possible to achieve both the strategic and specific objectives and priorities of the WMP CR.

The Waste Management Plan of the Czech Republic (WMP CR) offers economic instruments that can significantly influence the generation of waste and the methods of its management, such as the landfill tax, payments for operating the municipal waste-management system, and subsidy instruments whose purpose is the construction or modernisation of facilities for the recovery and disposal of waste. The economic impacts of fulfilling the objectives and principles of the WMP largely depend on the decision as to what function these instruments are to perform – whether primarily motivational (prevention and minimisation of waste generation) or fiscal (a source of funds for public budgets).

In the case of the landfill tax, the key decisions concern the level at which to set the tax, who should be its beneficiary, and for what purposes the revenue may be used. If this tax is to play a motivational role, it should be set according to the magnitude of the costs of alternative (environmentally desirable) methods of waste management, such as energy recovery and, respectively, material recovery. The break-even point for determining the level of the fee is the equalisation of the costs of landfill disposal with the costs of alternative methods of waste management when the waste holder is indifferent between the substitution methods of waste management. Setting the fee at a level that does not motivate substitution of the method of waste management reduces the effectiveness of this economic instrument. In simple terms – given the ban on landfilling from 2030, the landfill disposal fee should be set at a sufficiently high level to motivate the waste holder to use an alternative method of waste management. These methods should be at higher levels of the waste management hierarchy and waste holders should have simplified access to these methods.

Another factor that may contribute to the fulfilment of the objectives of the Waste Management Plan of the Czech Republic (WMP CR) is the redistribution of these fees to those waste management entities that are responsible for the waste management strategy and that allocate funds to projects which may significantly contribute to the fulfilment of the objectives. Redistribution of the charge to the budgets of municipalities, regions, and the State Environmental Fund (SEF), subject to the condition of earmarking, can thus ensure, for example, that a facility employing a preferred method of handling (e.g. material or energy recovery of waste) is built in the necessary territory.

The effectiveness of payments for operating the municipal waste-management system is also influenced by the decision as to what function these charges are to serve. If the motivational function of these payments is to be fulfilled, then their structure must reflect the performance of municipal waste management systems (volume of generation, collection frequency, size of collection container, length of collection routes, etc.). When a flat fee is set for the operation of the municipal waste management system, the fiscal function (replenishment of municipal budgets) is indeed fulfilled, but the motivation of households towards environmentally desirable methods of waste management disappears.

The effectiveness of subsidy instruments (from public, state, and European budgets) depends on whether the criteria of the circular economy are met, i.e. whether material and financial flows are being closed. The construction of a waste management facility thus makes sense if the financing of its operation is ensured from external sources (e.g. sale of suitably treated waste, secondary raw materials). The operation of such facilities is sustainable only if the revenues from sales cover the costs.

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