

Acknowledgements

This publication is a part of Cool4City - Green City by Smart Waste Management project (South-East Finland-Russia CBC Programme 2014-2020). The content of this publication will be part of another which is in preparation in collaboration with a different project, Sustainable Waste Management, in cooperation with the Russian Federation (coordinated by the Ministry of Environment of Finland and financed by the Ministry for Foreign Affairs of Finland). Both projects include preparing open and public reviews of Finnish waste management. In the case of clear synergies, the projects cooperated in preparing publications.

The Cool4City project focuses on the Helsinki metropolitan area in the Uusimaa region and Mikkeli in the South Savo region. The project collaborates with other South-East Finland-Russia CBC Programme projects - Cata3Pult and BBC1. So, to give a more comprehensive and holistic overview, this report also presents examples from South Karelia. Pirkanmaa region is also offered as an example.

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Sincerely,

Evilina Lutfi

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Table of concepts and abbreviations

(Not official, developed for the purpose of this publication)

Concept in English	Abbreviation	Original name in Finnish
Municipal Solid Waste	MSW	<i>yhdyskuntajäte</i>
Municipal Waste Management Organization	MWMO	<i>kunnallinen jätelaitos</i>
Municipal enterprise	ME	<i>kuntayhtiö</i>
Association of municipalities	AoM	<i>kuntayhtymä</i>
Statistics Finland	StatFin	<i>Suomen Tilastokeskus</i>
Finnish Real Estate Federation	FREF	<i>Suomen Kiinteistöliitto</i>
Limited Liability Housing Company	Housing company	<i>Asunto-osakeyhtiö /Taloyhtiö</i>
Helsinki Region Environmental Services HSY	HSY	<i>Helsingin seudun ympäristöpalvelut -kuntayhtymä</i>
South Karelia Waste Management	EKJH	<i>Etelä-Karjalan Jätehuolto Oy</i>
Pirkanmaa Waste Management	PJH	<i>Pirkanmaan Jätehuolto Oy</i>
Reuse Centre of Helsinki Metropolitan area	Kierke	<i>Pääkaupunkiseudun Kierrätyskeskus/Kierke</i>
Reuse Centre of Mikkeli	MTK	<i>Mikkelin Toimintakeskus</i>
Block of flats	BF	<i>asuinkerrostalo</i>
Terraced house	TH	<i>rivitalo</i>
Detached (one-dwelling) house		<i>omakotitalo</i>
Semi-detached (two-dwellings) house		<i>paritalo</i>

Introduction

In Finland, organizing municipal **solid waste (MSW)** management on an operational level or in practice belongs to **municipalities**. However, **the waste holder is responsible for covering expenses related to this organization**. Suppose waste is accumulated or generated on housing property. In that case, the property holder or owner, i.e., the **legal entity** or **natural person**, is responsible for joining the municipal waste collection network and paying bills to empty the waste bins and other possible charges or joining **users of waste local collection points**. No housing property (including summer homes) can be outside the municipal waste management system. Also, municipal public/institutional properties are a part of this system, but **this publication will focus mainly on housing properties and household waste**. Legislation, authority and other relative matters are not within the scope of this paper. These matters will be described in the upcoming (January 2022) joint publication of two projects – Sustainable Waste Management in Russia (coordinated by the Finnish Ministry of Environment) and Cool4City.

As the topic mentions, this **publication will focus on case examples**. However, case examples are better understood when the big picture is known. Waste management is a part of the economy in a country. **Chapter 1** of this publication is dedicated to general thoughts on the direct and indirect impacts of the MSW.

A case example from a big block of flats in a densely populated urban city is not the best or workable solution for properties like summer homes in sparsely populated rural areas. Understanding regional or local context is also relevant to managing waste flows efficiently and feasibly. To briefly open up the bigger picture and the regional context, this publication will present an overview of **population density, the spread of population between urban and rural areas, and the composition of housing properties and households living in said properties**.

Municipalities in Finland often join resources for MSW management. **Chapter 2** of this paper will briefly describe the so-called **municipal waste management organizations (MWMOs)**. It will focus on the general descriptions of **five MWMO case examples** and population spread in the operational areas of mentioned MWMOs.

Chapter 3 of this publication is dedicated to describing some **aspects of operational and business models in the light of three MWMO case examples**. These organizations are HSY (Helsinki Metropolitan area), Metsäsairila (Mikkeli in South Savo) and EKJH (South Karelia). Selected

from a broad spectrum of services are descriptions of property-specific waste collections, local waste collection points, sorting stations, and treatment/eco-industrial centres.

Chapter 4 will summarize some financial aspects of MSW separate collection and compare **property-specific emptying fees of some waste fractions within five MWMO case examples.**

Waste transportation is taking a remarkable share in the finances of MWMO's. **Chapter 5** will highlight this subject in the case of the HSY **example.**

Some **local Reuse Centres are making collaboration with MWMOs.** **Chapter 6** will present a pair **of examples** of such collaboration – Reuse Centre of Helsinki Metropolitan area *Kierrätyskeskus ("Kierke") & HSY* and Reuse Centre *Mikkelin Tomintakeskus & Metsäsairila.*

MSW flows and **MWMOs** are usually **connected to material and energy recovery processes.** **Chapter 7** will present **two examples of biogas ecosystems with the involvement of MWMO,** first, from the Mikkeli region and second, from HSY's composting and biogas production. Also, **one example of a waste-to-energy value chain** involving HSY waste fractions is included. HSY's Ämmässuo eco-industrial centre is a part of both.

From the **point of view of housing properties or housing companies of apartment buildings,** **Chapter 8** of this publication will show **compositions of annual housing costs** (incl. waste collection from the property) in the light of statistics provided by *Statistics Finland (StatFin)* and information from Index Building report of *Finnish Real Estate Federation (FREFF).* **Waste emptying costs** will be presented in the case example of 40 apartment blocks **of flats in Helsinki.**

MSW management value chain in Finland includes MWMOs and other key actors, such as **organizations under producer responsibility.** Households or natural persons can self-deliver their packaging waste free of charge to **RINKI eco take-back points.** **Electric and electronic equipment waste (WEEE)** can be delivered to sorting stations or shops free of charge. **Chapter 9** will visualize and summarize **some options of dealing with some fractions of household waste or goods suitable for reuse** from the perspective of a natural person living in the Helsinki Metropolitan area.

1. Thoughts on aspects of MSW management

MSW management is a mandatory and critical matter at the state, municipal, organization and consumer levels. All units contribute to the waste. The management process has a lot of dimensions and interconnections between economic, environmental and social impacts. The main objective of this

Ch. 1 is not to provide analyses but **to emphasize a better general understanding of the MSW management's direct and indirect economic and environmental aspects.**

MSW is a part of the economy – the generation of waste creates both expenditures and revenues. **Forming revenues for economic activity**, whether through reuse, material or energy recovery and **expenses from economic activity by households, municipal and administration services and businesses.** Waste holders, producers and property holders pay for MSW treatment and disposal; these costs constitute revenue for actors operating within the waste sector.

Revenues from material recovery refer to metal, electronic equipment, paper, and glass wastes sales. Also, revenues from sales of biomethane as fuel for vehicles, electricity and/or heating energy, residuals as organic fertilizers, which are products from the digestion process of organic waste, are considered revenues of material recovery. Revenues from reuse refer to sales of used goods and materials for the same purpose or upgrading/-cycling those to new goals with higher economic value. **Revenues from energy recovery refer to electricity and/or heating energy sales, products from the waste-to-energy or incineration process of municipal mixed waste, wood waste,** and some other waste fractions suitable for incineration.

In addition to the revenues from sales of goods and materials, biomethane fuel, electricity and heating energy, **revenues from services are forming a remarkable part of revenue flows.**

Examples of services related to MSW management are separate collection and transportation, recycling and treatment services.

In addition to the direct revenues from the sales of goods, materials, energy and services within the MSW process, there are **indirect revenues.** Examples of indirect revenues are connected to manufacturing waste collection tools and vehicles, treatment equipment and technology, etc.

Material recovery makes more financial and social sense than energy recovery, particularly from the perspective of employment, tax revenue and national account because of a longer value chain due to versatile use of recycled material for further processing and reusing, etc.

Development of operational models, processes, recycling technologies, awareness-raising and coaching, permissions and other environmental aspects, taking care of health matters, authorities' or governmental duties, statistics and reporting for different parts of the MSW value chain are examples of indirect operational expenditures. Various aspects of MSW operational economics include, for example, waste management fees at the municipal level, lifetime costs of waste-to-energy, need of land plots in urban areas for separate waste collection, construction of shelters for property-specific collection points, tools and transport vehicles for waste collection, transportation and self-delivering of

waste to sorting and treatment facilities, treatment and pre-treatment costs, and land need for final disposal.

Waste collection and treatment are direct expenditures, but changes in manufacturing processes of goods/materials before the usage phase and investments to facilities for reuse and recycling are indirect costs of waste management. New and innovative, technically and economically viable facility solutions must be introduced to increase the safe and high-standard recycling of waste. Expanding and developing a separate collection network is essential to obtaining clean waste for recycling. Securing appropriate disposal of waste fractions for which cost-effective recycling options have yet to be also identified forms costs in one hand. But on the other hand, developing, piloting, demonstrating and taking into use on an industrial scale provides business opportunities for enterprises.

Transportation of waste, especially of heavy fractions, have a direct economic impact in terms of expenditures on fuels and indirect impact in terms of amortization of roads and material costs for vehicle manufacturing. Additionally, to economic impact, the transportation of waste has direct environmental impacts in terms of noise and emissions (particles and CO₂) and indirect impact in terms of environmental pollution from fuel production and virgin materials used in vehicle manufacturing.

Urban planning is also interconnected to MSW management, such as the location of waste treatment facilities and the construction of shelters for property-specific separate waste collection. Adequate areas for economic needs should be sufficiently reserved close to the sites of waste streams origins, however taking into account environmental aspects. Ownership or renting and maintenance of the treatment facilities also have their input into the economics of the MSW value chain.

Consumption is very relevant to the waste matters concept in terms of using natural resources as in nation-wide economics. In Finland, waste management expenditures have a minor share in household consumption expenditures. From the value chain perspective, household (and private business and public sector) consumption expenditures reflect Finnish Gross Domestic Product (GDP) sales revenues. **Waste collection, transportation and treatment services** are, on the one hand, part of GDP providing income or service sales **revenues for waste enterprises** and, on the other hand, are **expenditures of households, municipal services and businesses**.

Consumption of natural resources is connected to the waste value chain. When there are enough steps back in the production chain, all matter has its origin in nature. This also applies to waste. Prior to waste status, waste fractions have been, among other things, products, packaging or industrial by-products that arise at different stages of the production process and consumption. Information on the increase or decrease in the amount of waste does not yet indicate the development of society. The

amount of waste can be reduced, even if people consume more if at the same time the cycle duration of materials increases as a result of better design or distribution increase.

The transition to a circular economy requires more materials and even less virgin raw materials from nature. A higher share of recycled material in total material use means more compensation for the need for virgin raw materials, lower environmental load, more jobs and value-added taxes.

The lower the **waste intensity** or the **ratio of waste to GDP**, the lower the environmental load to produce more products and services. The lower the **material consumption relative to GDP**, the better the resource efficiency.

Jobs in processing chains and substitutes for virgin raw material consumption form indirect benefits of recycling. Waste recycling expertise provides growth opportunities for Finnish environmental technology companies as domestic market references create export potential.

2. General overview of five case examples of MWMOs and population within operational areas of the organizations

By the end of 2020, the population of Finland was 5,533,793. The average population density was 18.2 inhabitants/km². Share of persons:

in urban areas was 72.1% (in inner urban area - 37.4%, in outer urban area - 23.9%, in peri-urban area - 10%),

in rural areas is 26.7% (in local centres in rural areas - 5.5%, in rural areas close to urban areas - 7.1%, in rural heartland areas - 9.3%, in sparsely populated rural areas - 4.8%).

As of 2021, Finland has 19 regions and 309 municipalities, 293 of which are in mainland Finland and 16 in Åland:

Nine cities with a population exceeding 100,000 (country's capital Helsinki with a population of about 656 000 followed by Espoo, Tampere, Vantaa, Oulu, Turku, Jyväskylä, Lahti and Kuopio), account for 1 % of Finland's area, 30 % of the country's population and 40 % of all jobs.

Half of the municipalities have fewer than 6,000 residents. These small municipalities account for about 50% of the land area, 15 % of the population, and about 10 % of all jobs. The smallest municipalities have fewer than 200 residents.

The most significant part of residential properties in Finland are one- and two-dwelling houses or detached and semi-detached houses – in 2020, the share was 89% counting 1,169,903 properties. Block of flats takes a share of 5% or accounts for 65,479 properties. One-person households are 1,254,300, covering 45% of the population, and two-person households are 33%. About 60% of one-person households or 804,732 people live in blocks of flats. Over four persons households were 338,853 taking 12% share from the total number of households, from which 228,785 or about 68% lived in detached and semi-detached houses. (Figure 1).

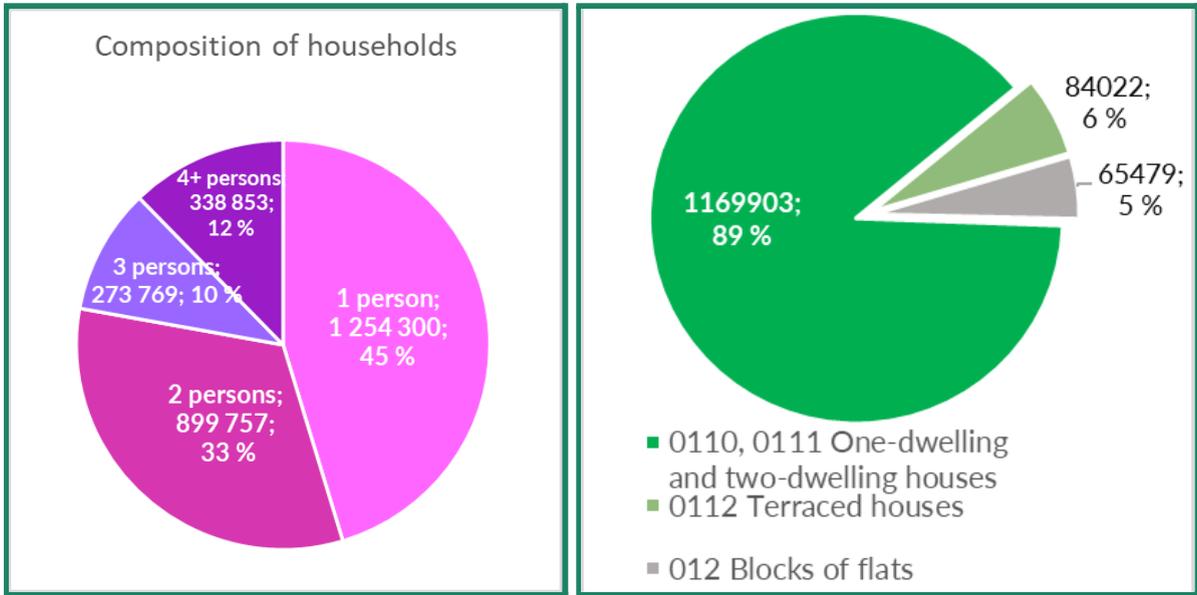
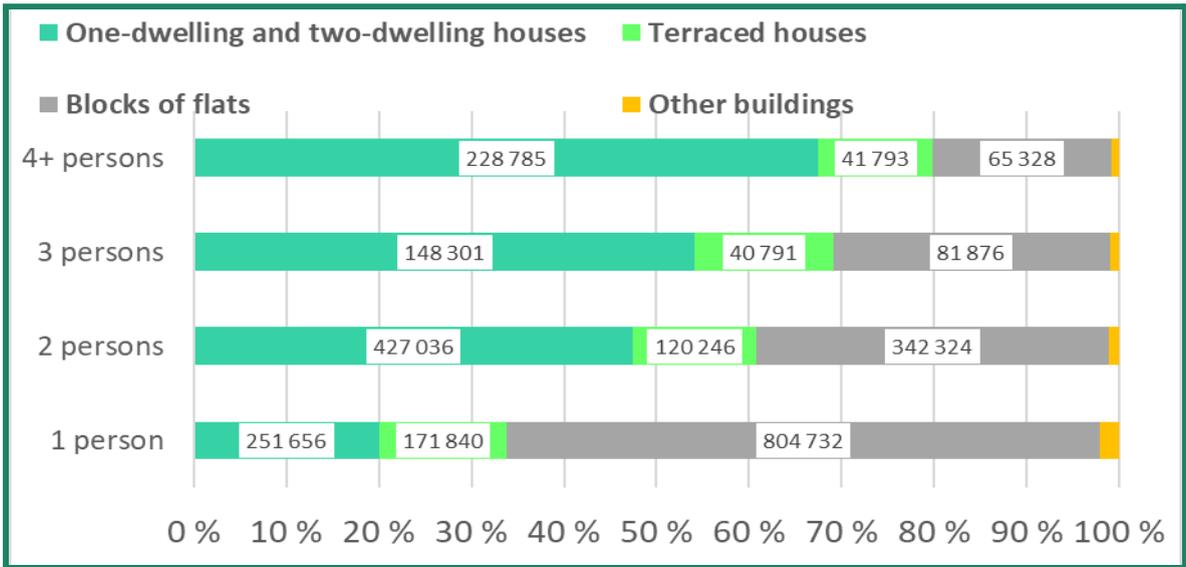


Figure 1. Composition of housing properties and households in Finland.

The MWMO case examples for this publication are selected based on existing collaboration and knowledge about the operational activities of the selected organizations. The selection of MWMOs covers **different types of administration and operating environments adding a holistic perspective to the publication despite the small number of case examples.**

Amount and density of population and types of housing properties are factors, which influence the waste management value chain and its management. For example, how many waste sorting stations, waste treatment or eco-industrial centres are feasible to establish and operate, how many waste local collection points are achievable, what kind of collaboration is feasible for organizing transportation and treatment etc. Table 1 presents a summary of the five case examples. Locations or municipalities mentioned in this publication are visualized on the map of Finland in Figure 2.

Table 1. Summary of the operational area of five MWMO case examples.

Abbreviation of MWMO and province <i>(maakunta)</i>	Covering area (cities and municipalities)	Number of municipalities within the operational area	The approximate number of inhabitants
HSY (Helsinki-Uusimaa)	Helsinki, Espoo, Vantaa and Kirkkonummi and Kauniainen	5	1 180 000
Metsäsairila (South Savo)	Mikkeli	1	55 000
EKJH (South Karelia)	Lappeenranta, Imatra, Parikkala, Rautjärvi, Ruokolahti, Lemi, Luumäki, Savitaipale and Taipalsaari	9	127 000
PJH (Pirkanmaa)	Tampere, Nokia, Pirkkala, Lempäälä, Kangasala, Orivesi, Vesilahti, Sastamala, Pälkäne, Juupajoki, Ylöjärvi, Hämeenkyrö, Ruovesi, Ikaalinen, Parkano, Mänttä-Vilppula ja Virrat	17	447 000
Kiertokapula	Hämeenlinna, Riihimäki, Hattula, Hausjärvi, Hyvinkää, Janakkala, Järvenpää, Kerava, Loppi, Mäntsälä, Tuusula, Valkeakoski and Nurmijärvi	13	

The majority of Finnish municipalities are joining resources for arranging MSW management. This publication presents case examples of MWMOs representing two types of organizations – **association of municipalities** (HSY case) and **municipal enterprises** (Metsäsairila, EKJH, PJH and Kiertokapula). Both municipal enterprises and associations of municipalities are **public entities**. However, they are listed in the register of companies and establishments. The number of municipalities within one MWMO in this paper varies from 1 (in Metsäsairila case) to 17 (in PJH case) (Table 1).

In further descriptions of MWMOs in this publication, abbreviations will be **derived from original names of organizations in Finnish, e.g. HSY, EKJH and PJH**. There are no abbreviations but only original names in Finnish in some cases. Full original names will be used in such case examples, **e.g. Kiertokapula and Metsäsairila**.

To help to recognize/understand Finnish names in this publication (and may be in other written materials):

- ❖ **“kierto”** is referring to **“circular”** (e.g. Kiertokaari, Kiertokapula, Salpakierto)
- ❖ **“Jätehuolto”** is **“Waste Management”** (e.g. EKJH, PJH, LHJ)
 - **“J”** in abbreviation refers to **“Jäte”** or **“Waste”**
 - **“H”** in abbreviation refers to **“Huolto”** or **“Management”**

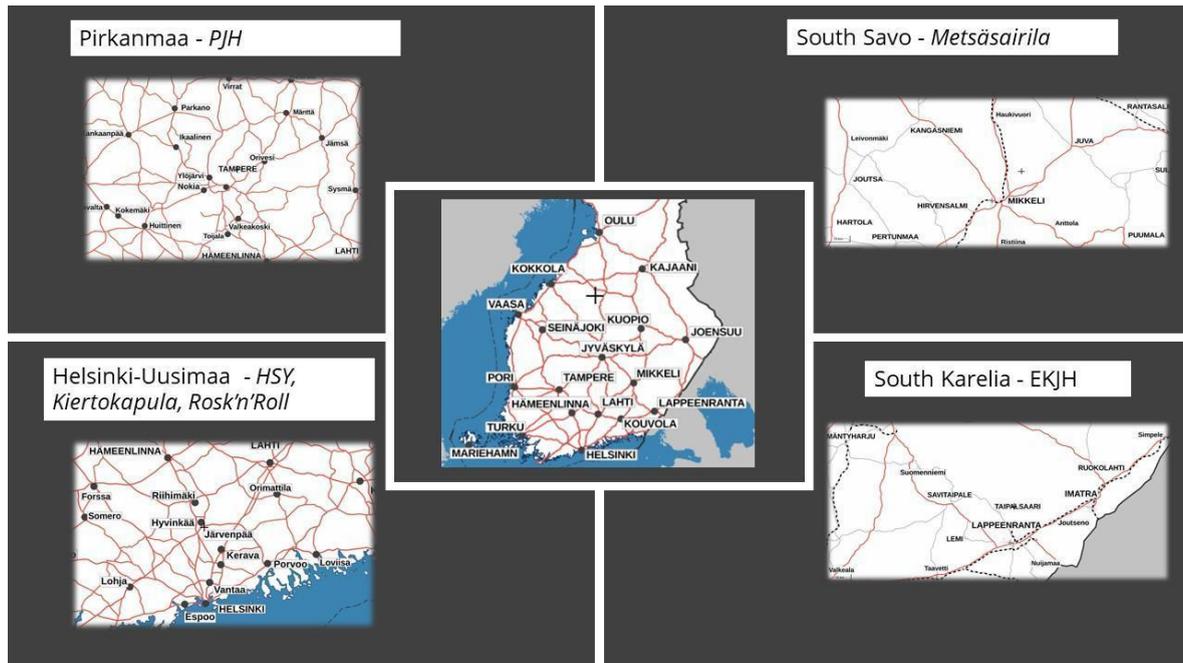


Figure 2. The locations/municipalities and MWMOs mentioned in this publication are on the map. (Source: MapSite of National Land Survey of Finland; <https://asiointi.maanmittauslaitos.fi/karttapaikka/?lang=en> ; Accessed on 9.12.2021)

a. HSY – case example from Helsinki Metropolitan area (Helsinki-Uusimaa region)

Helsinki Region Environmental Services (**HSY**) is an association of municipalities (*kuntayhtymä*), the founding and member municipalities of which are Espoo, Helsinki, Kauniainen and Vantaa. HSY provides municipal water supply and waste management, environmental education, training and information services.

HSY is operating:

- ✓ **Five sorting stations** (See Ch. 3) and **one mini-station** (Ch. 6)
- ✓ **Ämmässuo eco-industrial centre** (see Ch. 3)

HSY serves the inhabitants of Helsinki, Espoo, Vantaa, Kauniainen and Kirkkonummi. The municipalities under HSY's waste management operations differ in population density and types of living areas. In 2020, there were about 1.198 thousand inhabitants in the HSY area, of which 53% lived in Helsinki, 24% in Espoo, 19% in Vantaa, 3% in Kirkkonummi and 1% Kauniainen. The population density varied from 3066 inhabitants/km² in Helsinki to 109 in Kirkkonummi (Figure 3).

The major part of the population lived in urban areas. There were 111.099 housing properties in HSY's service area overall, 80.760 of which are detached and semi-detached houses.

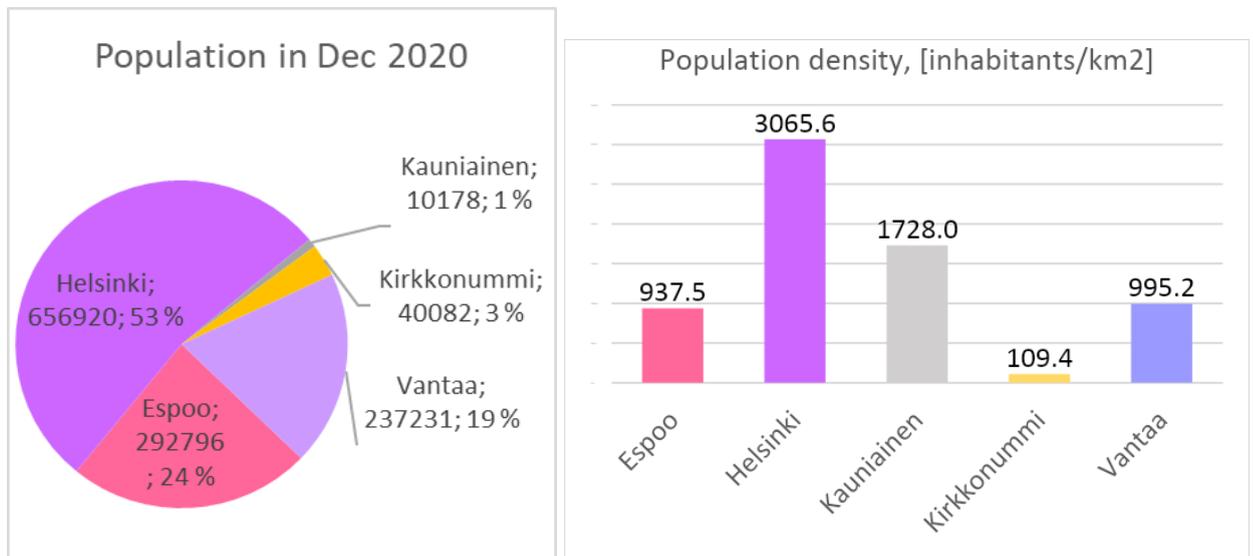


Figure 3. The population of the HSY area.

Table 2. Urban vs rural areas in HSY operational area.

	Espoo	Helsinki	Kauniainen	Kirkkonummi	Vantaa
Share of persons in urban areas, %	98,5	98,1	98,8	91,2	98,3
In inner urban area, %	73,7	95,6	97,3	0,0	68,3
In outer urban area, %	22,8	2,3	1,5	54,7	28,4
In peri-urban area, %	2,1	0,3	0,0	36,4	1,6
Share of persons in rural areas, %	0,1	0,0	0,0	7,4	0,0

HSY provides waste services for properties, operates Sortti - waste sorting stations, Ämmässuo eco-industrial centre and EKOMO – a resource-efficient circular economy ecosystem. HSY works to increase the recycling rate and promote a circular economy by improving internal processes, providing regional data, and participating in local and international research, development, and innovation projects.

In 2020 HSY:

- ✓ Emptied the waste bins almost nine million times
- ✓ Processed a total of 769 000 tons of solid materials
- ✓ Was left with more than 500 000 tons of material, some of which was utilized in the eco-industrial centre, Ämmässuo, within the waste treatment centre's landfill structures, and the other part remained in the centre awaiting a later recovery.

b. Metsäsairila – case example from Mikkeli (South Savo region)

Metsäsairila Oy is a municipal enterprise owned by the City of Mikkeli in South Savo. The main task is providing waste management services for the city. The company operates a sorting and recycling centre and small waste stations, organizes the recycling of recyclable waste, maintains and develops a network of waste stations in rural areas, and provides hazardous waste management, treatment of separately collected biowaste, and waste transportation. The company's tasks include planning, developing, and coordinating waste management and providing advice and information to the public.

Metsäsairila's area of operations is home to about 53.000 residents and is characterized by many holiday homes, around 10 300 in total. The biggest part of the City of Mikkeli population is living in the so-called outer urban area of the City of Mikkeli (over 40%), followed by inner urban areas (over 26%). In the rural areas close to urban areas living 13,5% and in peri-urban areas about 11%. About 7% live in sparsely populated areas. There are 21 people living in a km² of land area. (Table 3).

Table 3. Population statistics in Metsäsairila operation area.

Population 31 Dec 2020	52583
Population density, [inhabitants/km²]	20,6

Share of persons in urban areas, %	78,6
In inner urban area, %	26,7
In outer urban area, %	40,8
In peri-urban area, %	11,1
Share of persons in rural areas, %	20,7
In local centres in rural areas, %	0,0
In rural areas close to urban areas, %	13,5
In rural heartland areas, %	0,0
In sparsely populated rural areas, %	7,2

Metsäsairila operates:

- ✓ **3 small waste stations** in Haukivuori, Ristiina and Suomenniemi.
- ✓ **A sorting and recycling centre**

EKJH – case example from South Karelia region

South Karelian Waste management Centre (***Etelä-Karjalan Jätehuolto – EKJH***) serves whole South Karelia area. The EKJH service area includes the following municipalities: Lappeenranta and Imatra, Lemi, Luumäki, Parikkala, Rautjärvi, Ruokolahti, Savitaipale, and Taipalsaari municipalities, have 126,921 inhabitants. The City of Lappeenranta has 72,662 inhabitants, or 57% of the population, and Imatra has 20% (Figure 4).

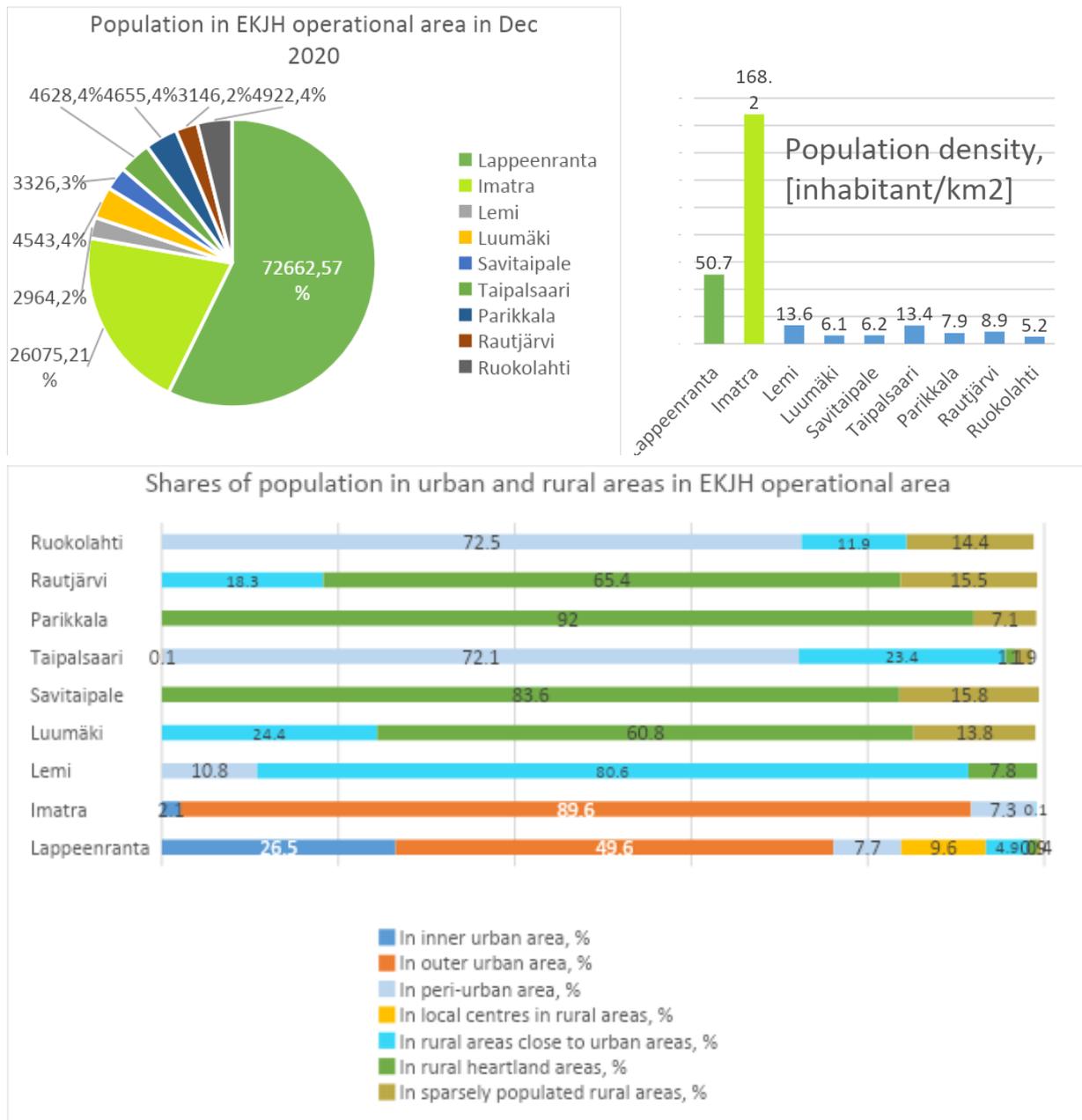


Figure 4. Population in EKJH operational area.

EKJH operates:

- ✓ 9 for use (sorting) stations
- ✓ Kukkuroinmäki treatment (eco-industrial) centre

c. PJH – case example from Pirkanmaa region

Pirkanmaa Waste Management (*Pirkanmaan Jätehuolto – PJH*) is the MWMO of the Tampere region established owned by 17 municipalities. It has 447 000 residents in its operational area (Figure 5)

and 86 employees. The company has won numerous international awards for their operating model in environmental and social responsibility categories. The turnover of the MWMO is around 45 million euros.

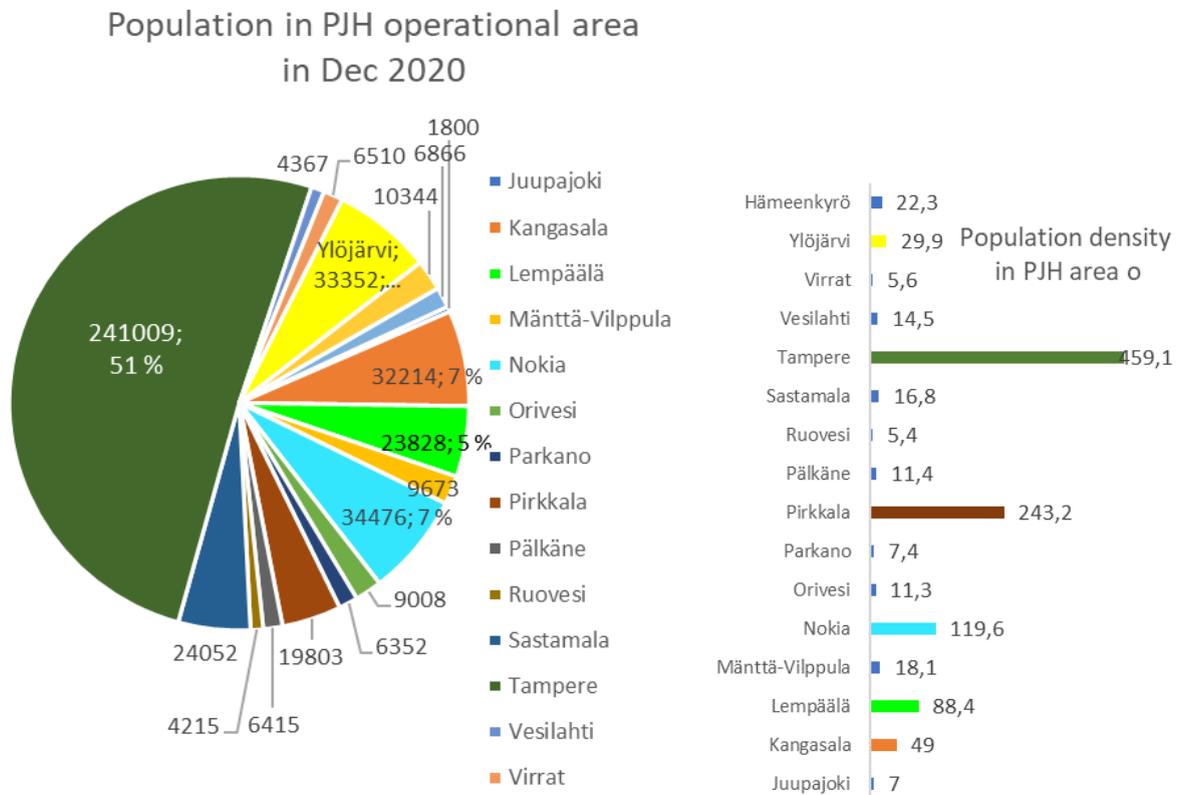


Figure 5. Population in PJH operational area

PJH is operating:

- ✓ **21 waste sorting stations**
- ✓ **2 waste recycling centres**

In addition to waste stations and recycling centres, in the operation area of PJH, there are 491 local waste collection points, 72 RINKI eco take-back points. PJH has also routing trucks with 380 stops collecting hazardous household waste, scrap metal and WEEE free of charge, and pick-up service for large items and larger amounts of waste that cannot be taken to regular waste sorting stations. PJH collects recyclable materials and mixed waste from every property. It has 24 transport contractors and 12 500 waste bin emptyings per day. Also, there are pipeline waste collections. PJH organizes energy recovery from waste with a local energy company, Tammervoima.

d. Kiertokapula – case example from Uusimaa region

Kiertokapula is municipal enterprise, the operational area of which covers 13 municipalities: Hattula, Hausjärvi, Hyvinkää, Hämeenlinna, Janakkala, Järvenpää, Kerava, Loppi, Mäntsälä, Riihimäki, Tuusula, Valkeakoski and Nurmijärvi. Kiertokapula is a social enterprise that does not distribute dividends to its owners. Waste Board Kolmenkierto is a joint municipal waste management authority that acts as a joint board of 13 municipalities. All municipalities are also shareholders of Kiertokapula Ltd. The Waste Board has 14 full members and personal deputies. The Board's responsible municipality is Hämeenlinna. <https://www.kolmenkierto.fi/jatelautakunta/>

Kiertokapula is operating:

- ✓ **five waste treatment sites:** Kapula in Hyvinkää, Karanoja in Hämeenlinna, Lumikorpi in Valkeakoski, Metsä-Tuomela in Nurmijärvi and Puolmatka in Järvenpää. Kiertokapula's waste treatment sites accept and treat a wide range of waste, and the entire process up to recovery or final disposal is handled using the latest expertise. The recovery rate of the waste accepted by Kiertokapula is almost 100%, meaning that most of the waste continues its journey towards utilization.
- ✓ **four depots operated jointly by municipalities and Kiertokapula:** Hausjärvi Municipal central warehouse and municipal depots in Loppi, Mäntsälä and Riihimäki. These depots accept household hazardous waste, WEEE and scrap metal free of charge.

In 2020, Kiertokapula Oy's waste fee accumulation was used as follows: €10,009,879 for waste treatment; €5,599,884 for waste transportation, and €1,484,734 for administration.

3. Some aspects related to operational and business models of three MWMO case example

One of the main objectives of this publication is to describe variations between some aspects of the operational and business models of some **municipal waste management organizations (MWMO)**. From the broad spectrum of **waste management services of MWMOs**, this publication will focus on three of them:

1. **Separate waste collection from properties or on the emptying of property-specific waste bins**
2. **Reception of self-delivered waste to sorting stations and**
3. **Eco-industrial/waste treatment centres**

3.1 HSY: property-specific waste collection, five Sortti stations, Ämmässuo eco-industrial centre

For property-specific waste collection, the waste management regulations of the HSY define which waste the property has to sort and collect. HSY's waste management regulations are valid in the Helsinki metropolitan area (Helsinki, Vantaa, Espoo, Kauniainen) and Kirkkonummi. There were 122,335 properties in HSY operational area in 2020, from which 111,099 were housing or residential properties. Most housing properties were one- and two-dwelling houses accounting for 80 760 properties. Block of flats were 17 551 in 2020 (Figure 5 and Table 4).

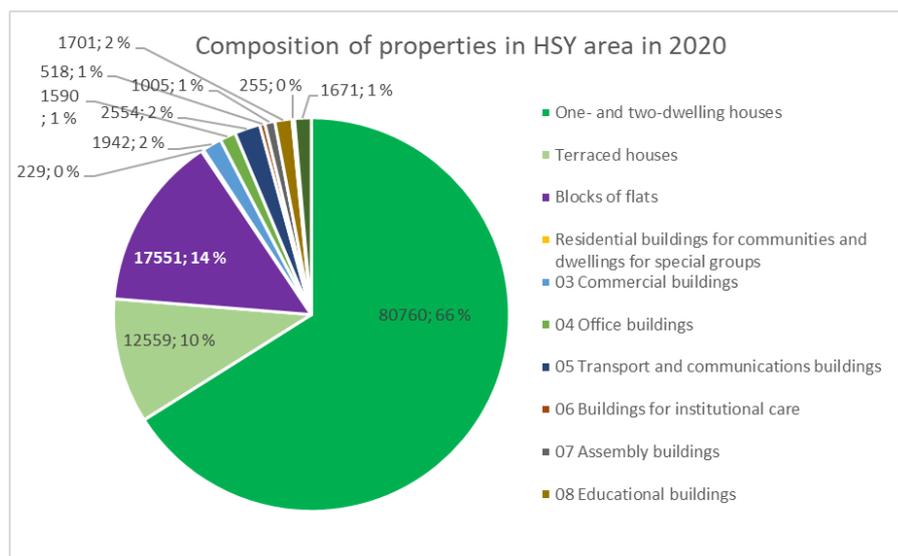


Figure 5. Composition of properties in HSY operational area in 2020.

Table 4. Composition of properties in HSY operational area in 2020.

	Espoo	Helsinki	Kirkko- nummi	Vantaa	Total properties/ buildings in HSY area
Total buildings (all types)	38843	42905	10012	30575	122335
Housing properties in total	36037	37228	9322	28512	111099
One- and two-dwelling houses	28740	21315	8113	22592	80760
Terraced houses	4020	4584	874	3081	12559
Block of flats	3211	11195	330	2815	17551
Other residential buildings	66	134	5	24	229
Commercial buildings	502	919	154	367	1942
Office buildings	370	958	50	212	1590
Transport and communications buildings	653	1333	142	426	2554
Buildings for institutional care	131	288	35	64	518
Assembly buildings	269	512	71	153	1005
Educational buildings	441	890	96	274	1701
Public utility buildings	108	65	31	51	255
Warehouses	332	712	111	516	1671

The **sorting obligations in housing properties** are defined by the number of apartments and, in other properties, the amount of generated waste. Usually, the more inhabitants, the more waste types are recommended to collect property-specifically. Effective waste sorting by residents reduces the amount of mixed waste. (Table 5).

Table 5.

Waste	Residential property	Other property
Mixed waste	always	always
Biowaste	5 apartments	25 kg/week
Carton packages and cardboard	5 apartments	25 kg/week
Glass packages	5 apartments	25 kg/week
Small metal items	5 apartments	25 kg/week
Plastic packages	5 apartments	15 kg/week
Paper	in accordance with the Waste Act	in accordance with the Waste Act

Waste collection must be arranged with waste collection equipment approved in the waste management regulations. The waste management regulations also state which types of waste should be collected on the property.

Waste collection may be arranged using:

- **140–660-litre manually movable waste bins suitable for mechanical loading** (carton may also be collected in 790-litre containers, HSY does not use roller cages for the collection of carton packages)
- For the collection of **biowaste, waste bins with lids and a maximum capacity of 240 litres** suitable for mechanical emptying may be used (bins of up to 140 litres may be used for the collection of biowaste generated in facilities).
- Waste containers with lids suitable for front, end or crane loading
- The sizes of deep collection containers range from a few hundred litres up to five cubic metres
- Waste press containers

Standard dimensions of the most common waste containers

The dimensions vary somewhat depending on the manufacturer of the container.

Nominal size	Width	Depth	Height
140 l	510	560	1,080
240 l	600	720	1,100
360-370 l	700	850	1,100
660 l	1,250	850	1,250

At this moment (in 2021), separate collections are provided for these HSY waste bins, and emptying frequencies are presented in Table 6 and Figure 6.



Figure 6. Composition of waste bins provided by HSY for different housing properties.

At this moment, the **minimum requirement in residential properties with less than five apartments and detached houses is mixed waste**. However, it is quite a general practice and

possibility that better sorting occurs, meaning more waste fractions are separately collected. To small apartment properties – from five to nine apartments – HSY has been delivering since spring 2021 multi-compartment waste containers of volume 660l. Composition of the four compartments: two separate bigger parts for plastic packaging and cardboard and two smaller separate parts for glass packaging and small metal objects. It is not mandatory to use the HSY's multi-compartment container. Regular, more giant bins could be used for plastic packaging and cardboard. The separate collection of plastic packaging waste became mandatory for 5-9 apartment properties in May 2021.

Table 6. HSY waste bins and emptying frequencies

	Biowaste	Small metal	Glass	Cardboard	Plastic packaging	Mixed waste
5-9 apart.	140 or 240 l, once a week or every other week	660 l multi (four)-compartment container: two larger compartments (one for plastic packaging, one for cardboard + two small compartments (one for small metal, one for glass); once a week or every other week				660 l
10-19 apart.	140 or 240 l,	240 l, emptying every 8 weeks	240 l, emptying every 8 weeks	660 l,	660 l, emptying once a week or every other week	660 l
At least 20 apart.	140 or 240 l	240 l	240 l	660 l	660 l, emptying once a week	660 l, emptying from 4+ in a week to once a week

Smaller than 660 l mixed waste bins can be ordered by small properties:

- Ø 140–240 litres is only for detached or semi-detached houses.
- Ø 300–360 litres can only be ordered for properties with fewer than 5 households.

What should not be sorted into mixed waste:

- Hazardous waste
- WEEE - Electric and electronic equipment waste
- (Large) metal items
- Large amounts of non-combustible waste or large non-combustible items > deliver to a Sortti Station
- **Recyclable materials with their separate collection**, such as
 - Biowaste
 - carton and cardboard packaging
 - glass bottles and jars
 - metal packages
 - plastic packaging
 - paper

HSY empties the **multi-compartment waste bin** and the **biowaste bin** once a week or every other **week** according to the amount of waste accumulated in the housing company.

In 2019 HSY is collected tons of MSW, e.g. mixed waste – 179213, biowaste – 42058, carton - 10581, glass - 4237, plastic packaging- 2259, metal -1744 (Figure 7). Collection or emptying times of HSY by a waste fraction or waste bin type in 2019: mixed waste - 5621318, biowaste – 1597609, carton – 910854, plastic packaging - 511062, metal- 108175, glass – 105201, multi-compartment bin collection – 18284, cardboard - 8085 (Figure 8).

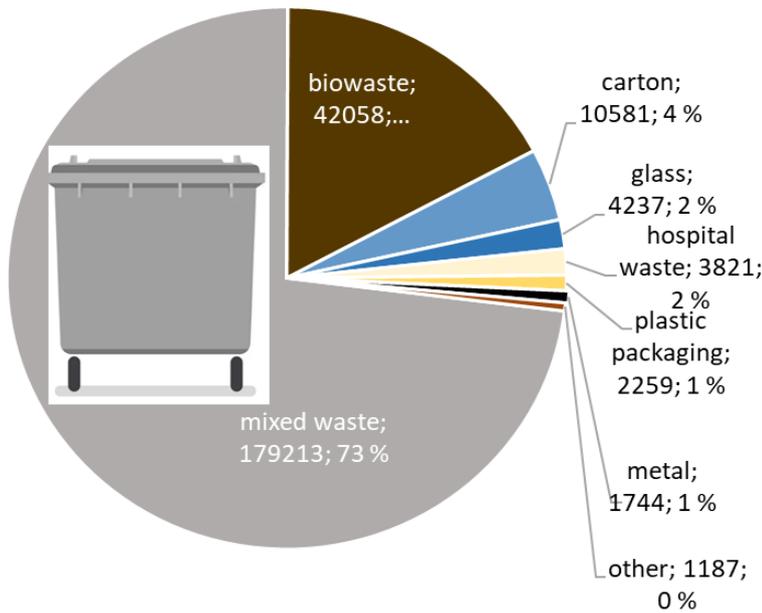


Figure 7. HSY collected waste from the properties in 2019, [in tons].

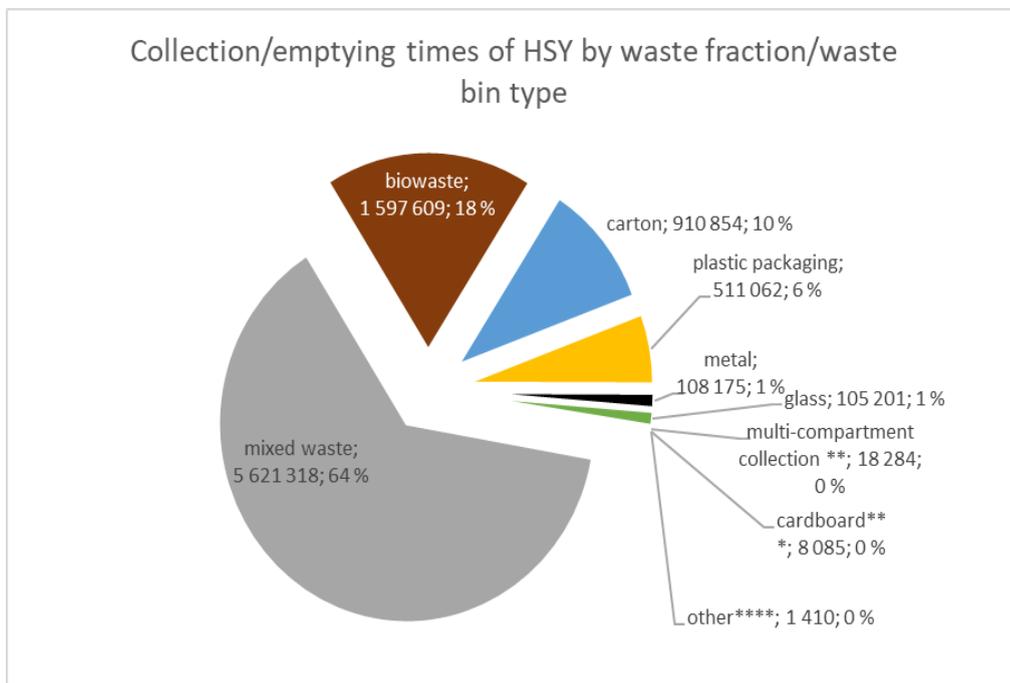


Figure 8. Waste bins emptying times of HSY in 2019.

Separate plastic packaging waste collection has been implemented on a volunteer basis and has become obligatory in the Helsinki Metropolitan area since 2021.

In the HSY area, emptying **mixed waste** bins is the most expensive. For example, emptying waste bins once a week of the same volume of 660 l have significant differences in the fees: Mixed waste - €12.44, plastic packaging waste - €6.86 and cardboard - €4.29 (Figure 9).

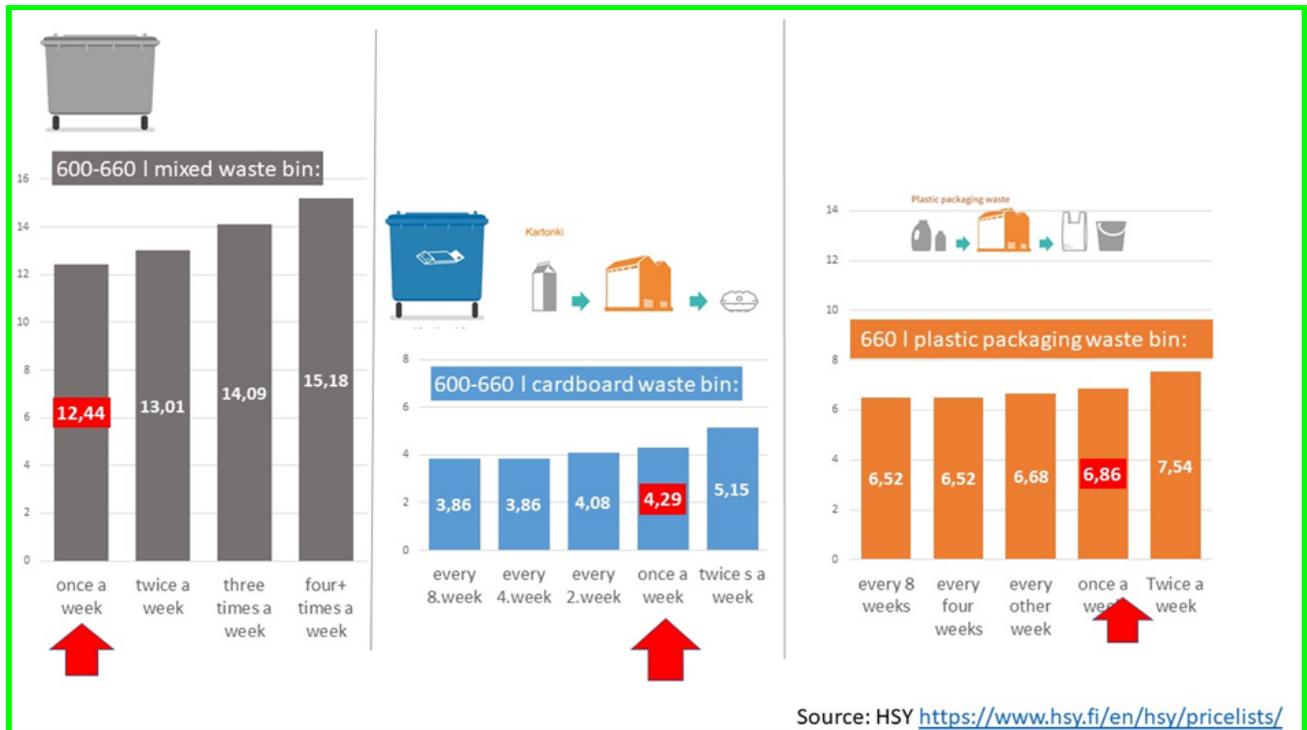


Figure 9. Example of property-specific emptying fees of HSY for three waste fractions and different emptying frequencies.

The fee for collecting **multi-compartment packaging** waste bins (660 l, applies for 5-9 apartment houses) in 2021 is 7.65 €/emptying.

HSY's pricing of **biowaste** differs by emptying frequencies and by type of customer. For households, fees are lower than for institutions (Figure 10). Once a week or every other week, emptying costs 6.58 € for households vs 10.87 € for institutions. Four times a week or more frequent collection costs 8.1 € for households vs 13.06 € for institutions.

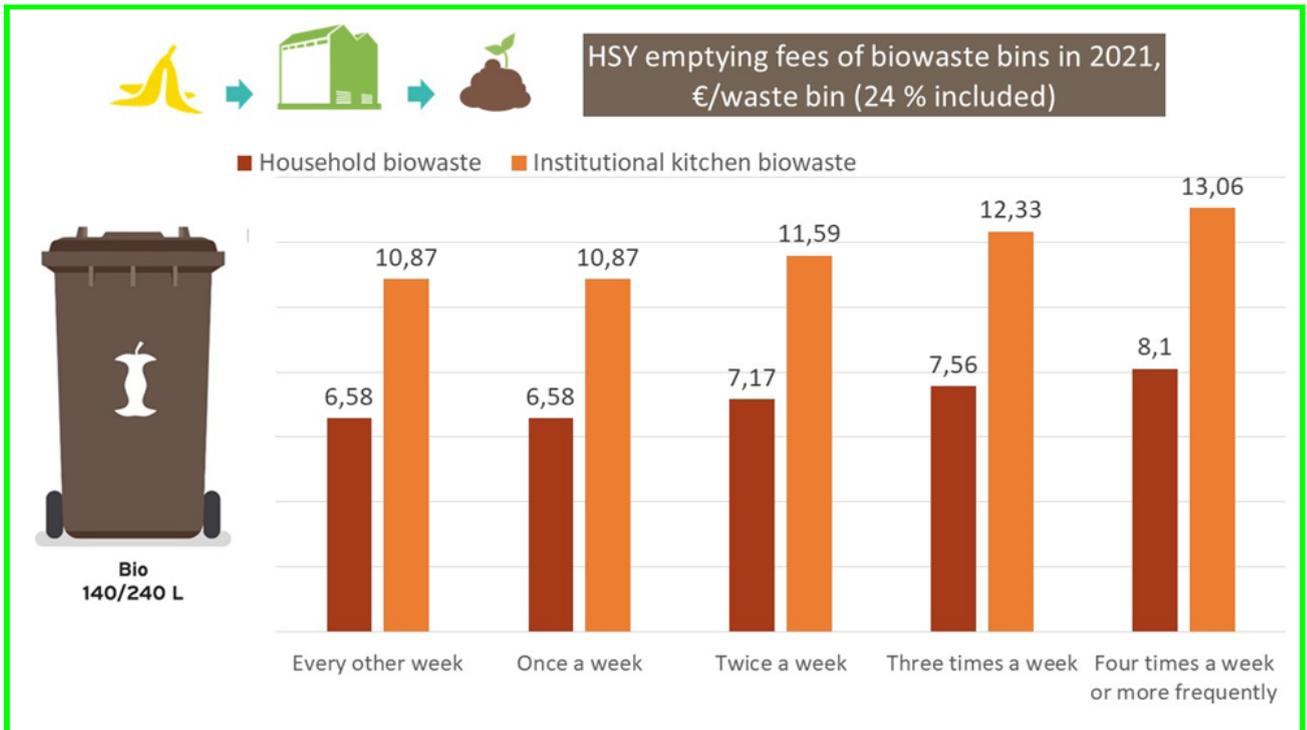


Figure 10. HSY emptying fees for biowaste - household vs institutional kitchen waste.

HSY prices emptying mixed waste bins in detached and semi-detached properties according to emptying frequencies and volumes of the waste bins. As already said before, mixed waste is the most expensive, and its price grows each year. For example, from 2020 to 2021, there was about a 10% growth in emptying costs of 300-360l (Figure 11).

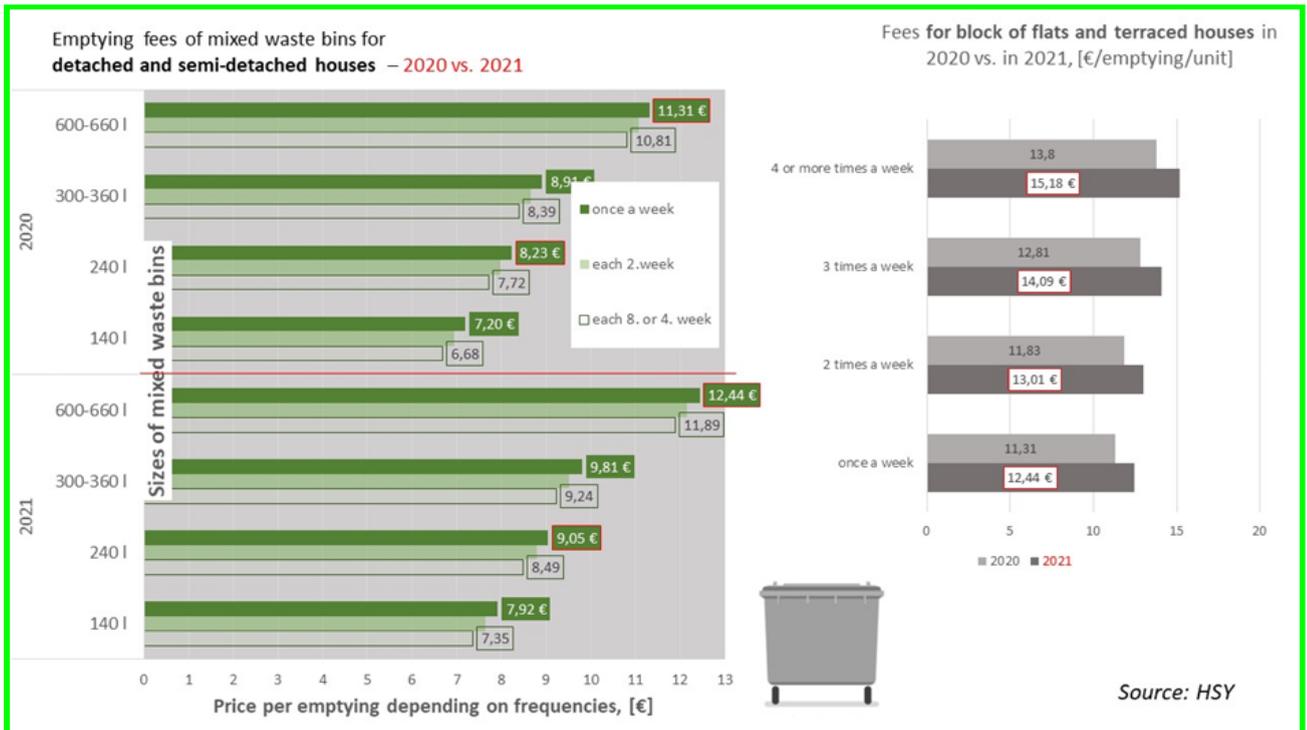


Figure 11. Pricing of mixed waste by HSY for different housing properties, emptying frequencies, waste bin volumes - in 2020 vs 2021.

HSY is pricing mixed **waste bins from a block of flats and the terraced house** according to emptying frequencies but provides different options in detached and semi-detached houses (from once a week to more than four times a week). The volume of the waste bins has to be 660 l — more frequent emptying, more expensive fee. By setting higher prices of mixed waste, HSY is motivating households to sort more of their useful waste fractions for recycling. The annual growth rate of fees of mixed waste collection is also higher than that of recyclable fractions. Annual fees' growth 2020-2021 for a block of flats and terraced houses was 9.1% (Figure 11) :

	2021	2020
once a week	12.44	11.31
2 times a week	13.01	11.83
3 times a week	14.09	12.81
4 or more times a week	15.18	13.8

Rental fees of waste bins are not included in the emptying prices of HSY. Those are defined week-based separately. The rental fee for a 140–240 litre bin is €0.25/week, 300–360 litre - €0.35/week, 660 l - €0.47/week. In the case of damaging a waste bin by a client, this is charged: 55€ for 140-240 l bin, 70€ for 360 l bin and 140€ for 660 l bin. Renting waste bins from HSY is not mandatory. HSY charges its customers separately for damaging waste bins: €55 for 140-240 l bin, €70 for 360 l and €140 for 660 l bin.

The total annual cost of property-specific waste management for housing companies of detached property owners in the HSY area is a sum of emptying and renting fees. Those are described in the HSY bills to customers in separate lines. Figure 12 presents the annual costs of mixed waste by different volumes of waste bins and different emptying frequencies. Mixed waste management of **660 l waste bin with emptying frequency once a week costs a client in total €672** in 2021. And for example, for detached property owners, mixed waste management of **300-360 l bin with emptying frequency once in two weeks costs €267** in total.

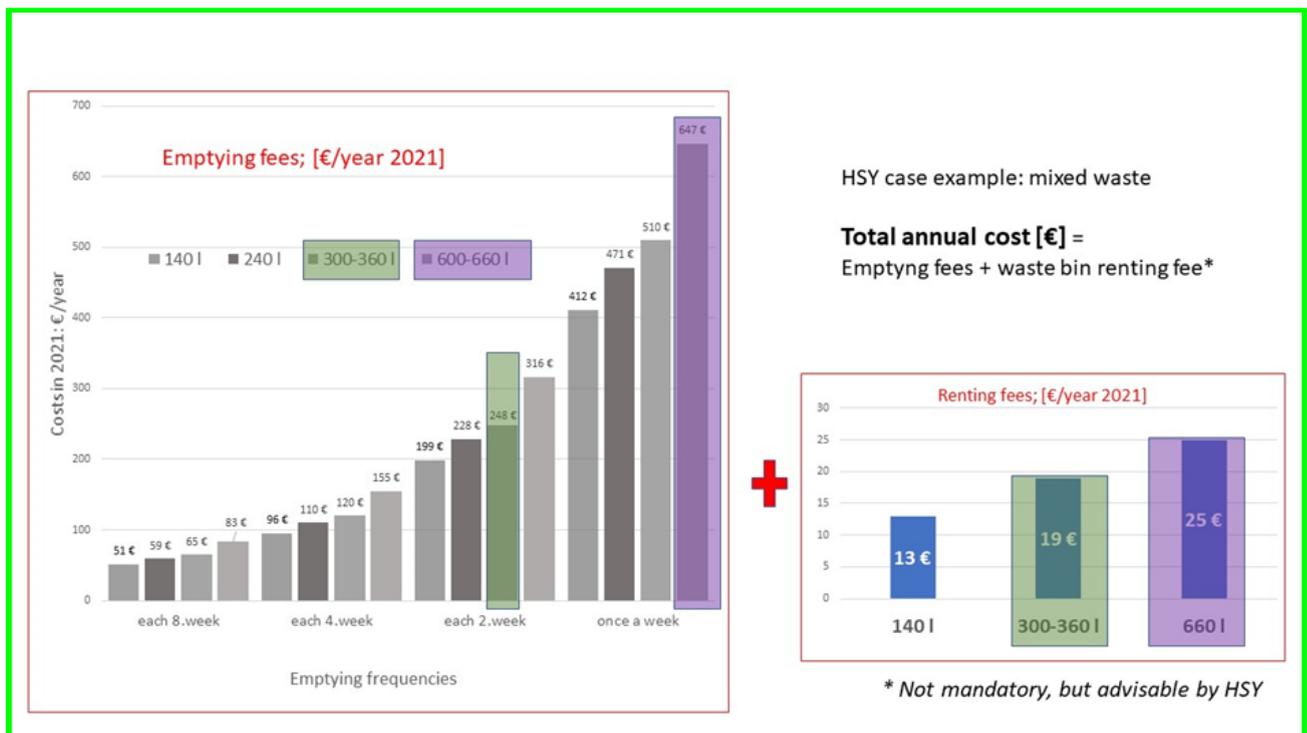


Figure 12. Examples of total annual costs of mixed waste in the HSY area for different waste bin volumes and emptying frequencies.

Connection of Building order regulations to waste bin shelters – case City of Helsinki

Organizing property-specific waste collection has other matters that should be considered in addition to waste management regulations. One of such matters is **building order regulations** (*rakennusjärjestyksen määräykset*). The municipality is obligated to have a building order. Regulations of the order may differ in different areas of the municipality. The building regulations set out the provisions necessary for the planned and appropriate construction, considering cultural and natural values, and realizing and preserving a suitable living environment due to local conditions. The provisions of the Building Regulations must not be unreasonable for the landowner or other right holders. The municipal council approves the regulations. The provisions of the Building Regulations may concern the construction site, the size and location of the building, the adaptation of the building to the environment, the construction method, plantings, fences and other structures, the management of the built environment, the organization of water supply, the definition of the planning needs in the area and other similar local construction issues.

The City of Helsinki has published a [guide that describes the construction of waste shelters principles in different urban environments and defines when a permit must be applied for waste shelter.](#)

The shelter is a subject of the Building Regulations. Adequate facilities for collecting and sorting waste and other arrangements for waste management must be proportionate to the size and use.

If waste collection equipment is placed in the plot's yard, a protective waste shelter must be built, canopy or fence, or landscaped with plantings. According to the Building Regulations, a maximum of 30 square meters of construction of a fence, canopy or shelter for waste collection is exempted from applying for an operating permit. In protected buildings, the requirements arising from Building Protection must be considered.

Waste shelters should be placed at a height away from the neighbour's border, or other structures shall be located at the boundary of a neighbouring plot at least for a long enough time that when drawing a plot of land at an angle of 45 degrees, the structure must remain entirely under it. Placing the structure closer to this requires a neighbouring plot consent of the owner or holder. If the location of waste management facilities is intended to be relocated and impacts the neighbour's interests, it is worth the builder to consult the neighbours. The structures should also be placed **at a height away from the street side boundary of the plot.**

If the town plan prohibits it, waste management facilities may not be located in the yard. Waste shelters should also not be placed along the street on the part of the plot designated for planting in the town plan. Construction must always ensure that waste shields do not pose a health or safety risk.

Health and safety aspects of organizing a shelter for property-specific waste collection

Ventilation. Exhaust air should lead at least 8 meters away from the adjacent air intakes and open windows in buildings. When locating a waste room in the building space, exhaust air is removed above the water roof (the regulations appear in the Finnish Building Code).

Inspections. For example, in the case of odour nuisance (*hajuhaitta*), municipal environmental services conduct inspections at the request of the housing company.

Property waste collection must be carried out so that HSY Waste Management transport and persons have access to the waste bins (or to deep collection containers).

The containers can be placed in the waste room in the building or on a waste fence or canopy in the yard. Also, joint arrangements by a group of properties may be considered.

In the inner urban area of Helsinki (districts 1-27) and in the new block of flats, waste management in the premises should, as a general rule, be located on the ground floor of the building and not in the yard. It is also possible to use different deep collection or suction collection systems, whereby the above-ground parts are smaller in size.

Share of responsibilities between municipality and property or land plot owners on maintenance and cleaning of public areas – case City of Helsinki

The obligation to maintain and clean the streets, squares, street squares, parks, plantations and other comparable public areas in the Town Plan (*asemakaava*) area belongs partly to the municipality, partly to the owner of the plot or other area. The division of tasks is based on **Law on the maintenance and cleaning of the street and certain public areas** (*Laki kadun ja eräiden yleisten alueiden kunnossa- ja puhtaanapidosta*). The obligation enters into force when the municipality allows the area to be used as indicated by the town plan. According to this law, a street handed over or considered to be handed over to the public in accordance with the Town Planning Act, the Building Act or the Land Use and Building Act must be kept in good condition and clean.

Division of responsibilities in the City of Helsinki on street maintenance

According to the division of responsibilities:

- **in the city centre, the property is responsible for:**
 - o emptying the rubbish bin at the bus or tram stop if the stop is on the sidewalk at the property
 - o street cleaning, i.e. removing dirt, debris and loose objects from the street

- keep the pavement and carriageway clean in place up to the centerline of the street, but not more than 15 meters wide or 24 meters wide if there is a planting lane in the street area
- **in the suburban area**
 - the owner of the land plot or the property handler is responsible for the maintenance of the land plot.
 - the city is responsible for cleaning the entire street, i.e. the carriageways and sidewalks. The exceptions are private roads and state-owned roads.

The City charges the property owners a fee to pay for maintenance.

Helsinki City Construction Services STARA - Stara Public Enterprise, owned by the City of Helsinki, is a versatile expert in construction, environmental management and logistics.

In Helsinki metropolitan area, **properties adjacent to each other** can make a contract with MWMO to use a jointly owned waste container. This concept is so-called *block collection (kortteli-/kimpakeräys)*. The parties to the contract concerning joint use are all the properties using the jointly owned waste container and its location.

The contract on joint use must have a principal contracting party, which acts as the contact person to HSY for container emptying and maintains the contact information on the waste container users, i.e. the joint owners in the contract.

If the waste container needs to be placed outside the property boundary, agree on the placement of the container with the landowner. Obs.! The National Land Survey of Finland manages the register of the landowners.

Holiday homeowners can also agree on using a jointly owned waste container with their closest neighbours, the road maintenance association, or another organization. It is a good option, for example, in situations where there is no road to the holiday home.

In the City of Helsinki, the placement of deep collection containers does not require permission (according to the Construction Regulations of the City) if the containers are model-approved and surrounded by a fence, wall or plantation, and placed in the yard so that they are not directly related to the street space. <https://www.hsy.fi/en/waste-and-recycling/joint-use-of-waste-containers/>.

HSY Sortti Stations

For example, hazardous waste, WEEE, construction and gardening waste is not allowed to be collected on the properties. For these purposes, HSY operates sorting stations.



There are five waste **sorting stations or Sortti Stations** (*Sorttiasema*) and one mini-station in the Helsinki metropolitan area, which MWMO HSY operates. The stations are located close to bigger roads (Figure 13) and are easily reachable by customers. Two of the stations are located on the territory of the City of Helsinki (in Kivikko and Konala districts), two on the territory of the City of Espoo (in Ämmässuo and Jorvas districts) and one in the City of Vantaa (in Ruskeasanta district).

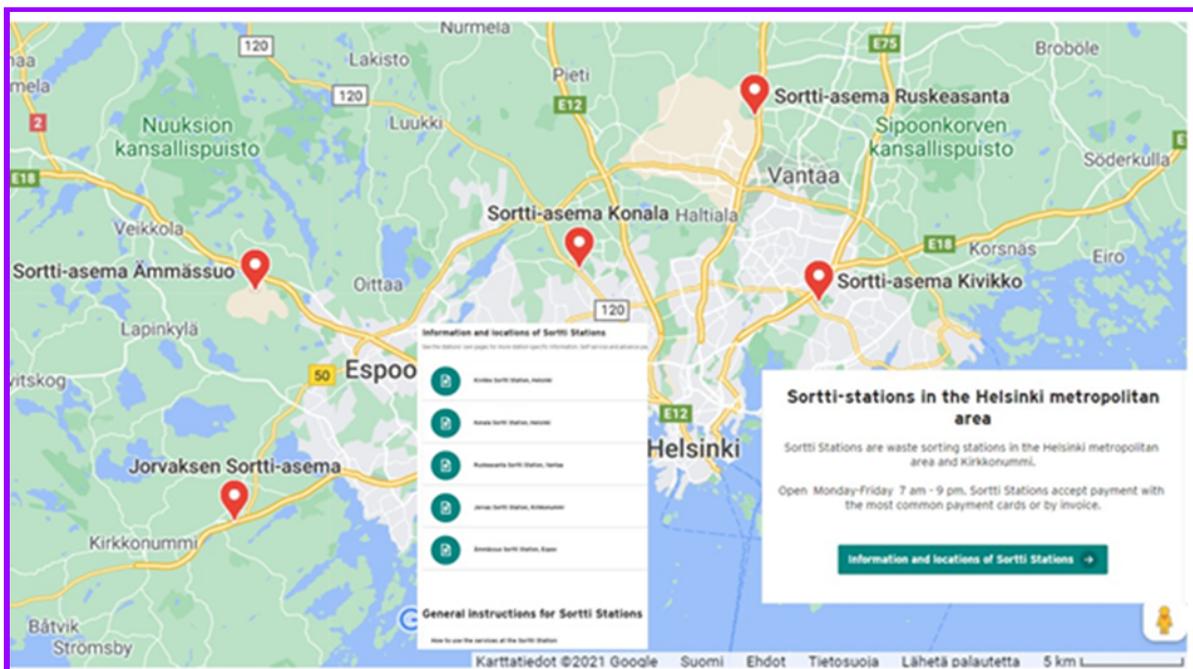


Figure 13. HSY Sortti Stations locations and info. Source: HSY

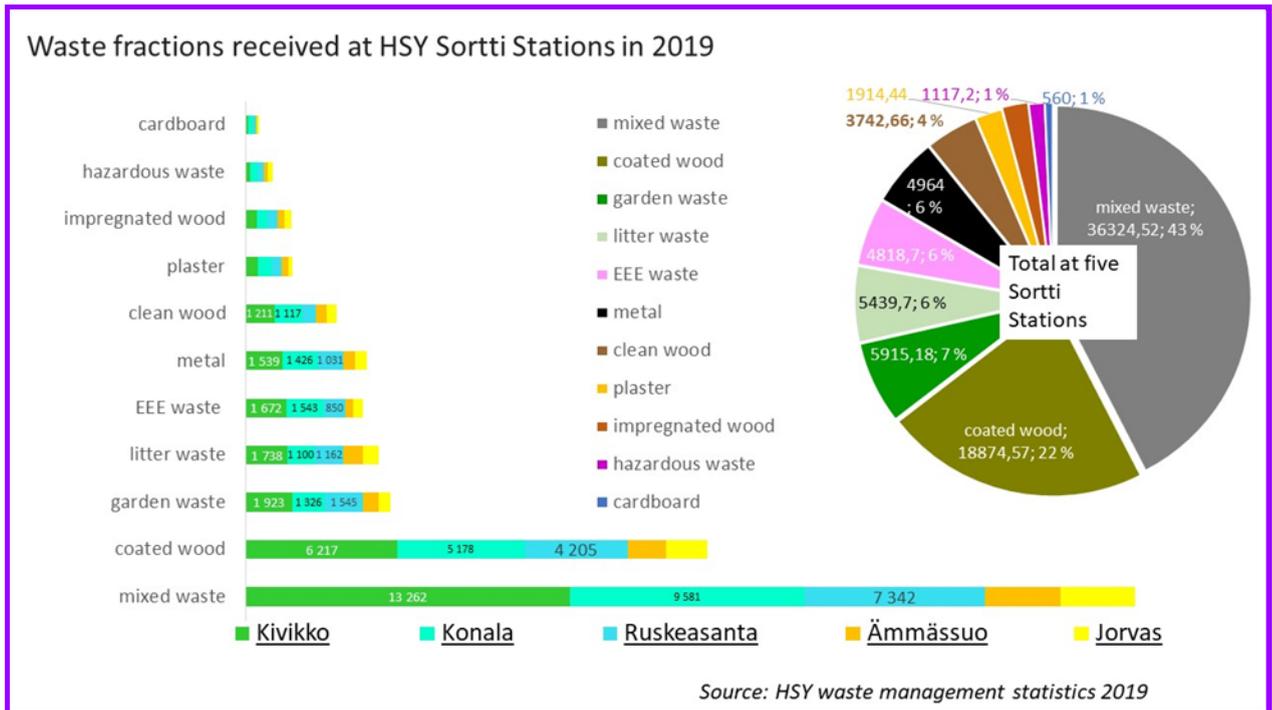


Figure 14. Waste fractions that were received at HSY Sortti Stations in 2019.

HSY provides general instructions via the organization's website on using the services at the Sortti Stations.

A total of 581,867 customers visited HSY's Sortti stations in 2020, 510,103 customers in 2019 and 473,132 customers in 2018. For example, in July 2020, there were 60,908 customers, but in February – 31,116. (Figure 15).

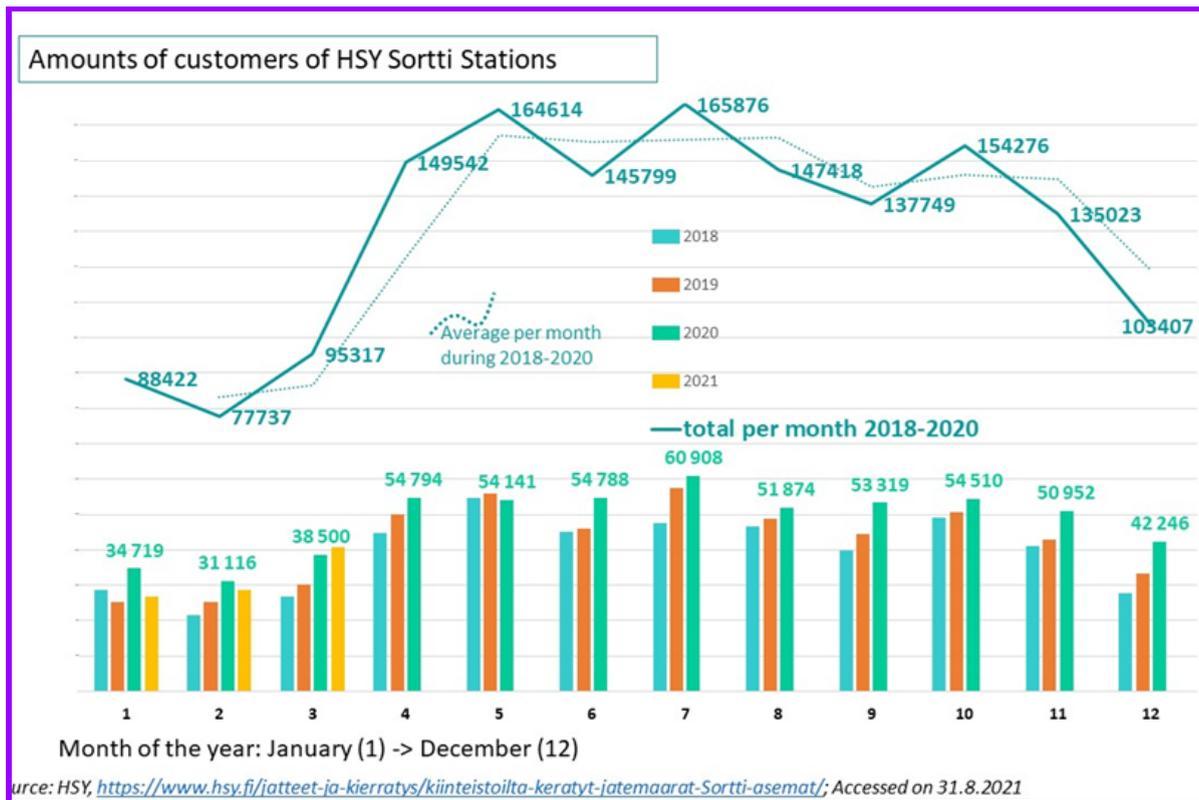


Figure 15. The number of customers of HSY Sortti Stations.

It should be noted that the HSY stations in Vantaa and Espoo are used not only by residents within municipality borders of the operational area of HSY. For example, the Ruskeasanta station is also used by residents from Tuusula since there is only about 1 km from the Ruskeasanta site to the border of Tuusula municipality.

Part of waste fractions are accepted at HSY Sortti Stations from households free of charge, and the other part is subject to payment. (Figure 16 and Table 7). **Free waste or no charge for separately sorted: Carton and cardboard, Hazardous waste from households, Glass packaging (bottles and jars), Metal, Paper, WEEE.**

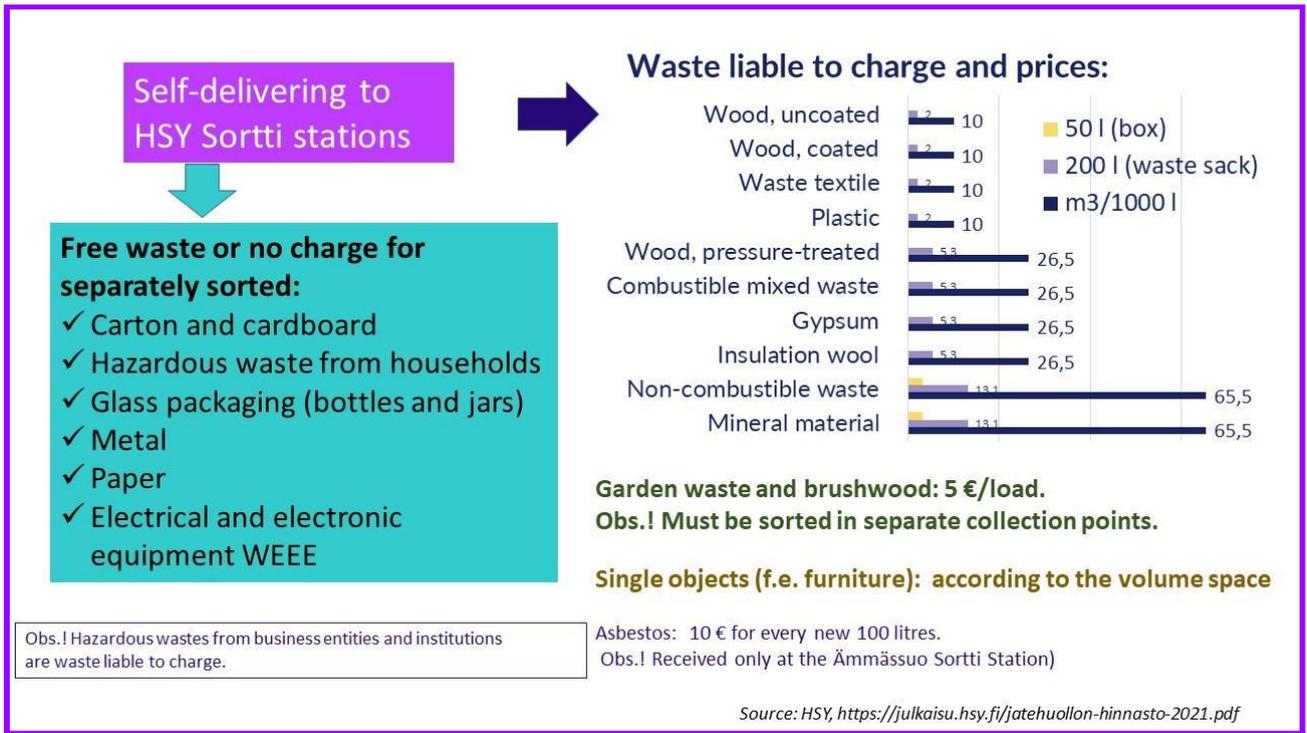


Figure 16. Free of charge vs waste liable to charge for self-delivering by households to HSY Sortti Stations

Table 7. Waste liable to charge at HSY Sortti Stations and prices, [€]:

	m3/1000 l	200 l (waste sack)
Mineral material and non-combustible waste	65,5	13,1
Insulation wool, gypsum, pressure-treated wood, combustible mixed waste	26,5	5,3
Plastic, waste textile, coated and uncoated wood	10	2

HSY is also operating an eco-industrial centre located in Espoo Ämmässuo.

The HSY eco-industrial centre located in Ämmässuo, Espoo, is a modern touchpoint of waste management and circular economy (Figure 17).

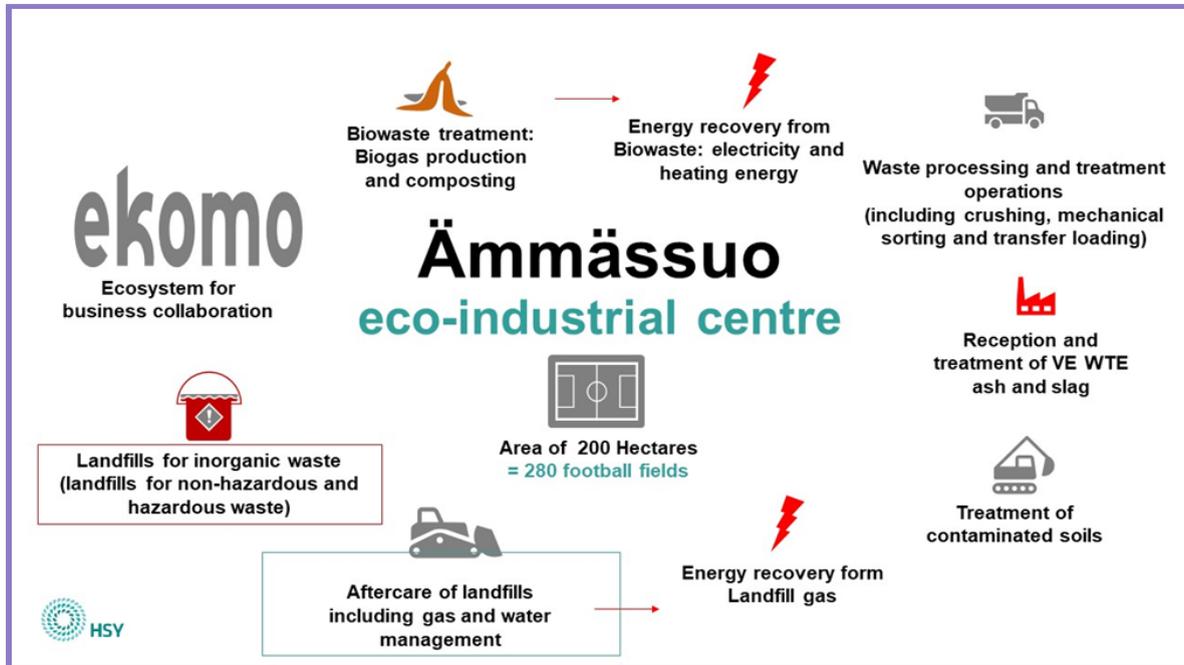


Figure 17. Activities within HSY Ämmässuo eco-industrial centre. Origin version of the visualization: HSY.

Spanning about 200 hectares, the Ämmässuo eco-industrial centre offers services such as:

- treatment of biowaste into biogas and compost
- treatment and utilization of ash and slag from the waste-to-energy plant
- collection and utilization of landfill gas.
- treatment of contaminated soil.
- **sorting of various waste loads** and
- delivering the materials for reuse.

The Ämmässuo eco-industry centre **accepts waste loads transported by lorries or other large vehicles**. Customers (the producer and the holder of the waste) must be aware of the quality, characteristics and origin of the waste in their possession, as well as its suitability for landfill use. This

information is provided upon delivery. A Waste Transportation Document is required for certain types of waste per the current legislation.

The treatment fee is determined by the waste load's weight, type, and quality. The load is assessed at the reception. If a load includes several different types of waste, the fee is determined based on the most expensive type of waste (Table 8). The weighing fee for loads classified as waste is about 20 €/load. HSY charges an additional fee of 55 €/ton for the costs arising from the misbehaviour of the person bringing the waste (E.g., Scraping of a cooled truckload, cleaning a littered passageway, delivery of an uncovered cargo that, according to the legislation, should be transported with a cover, transferring a load that has been emptied in the wrong place, other additional machine work, missing Waste Transportation Document or incorrect waste type declaration).

Table 8. Fees examples for waste loads acceptance in HSY Ämmässuo eco-industrial centre.

Title	Description	Rate €/ton
CDW Wood waste	Pallets and wooden packaging. Uncoated wood waste.	0
CDW Coated wood		24.8
CDW (for reuse or final disposal)	Including pre-processed waste. Including waste containing more than 10% soil and rock material.	167.40-223.20
Solid food waste	Fully biodegradable and technically suitable for the treatment process. Including packaged. No glass or metal containers. By-product class 3. From commerce and industry, industrial kitchens, restaurants, etc.	24.80-186.00
Mixed waste	Miscellaneous municipal waste. Waste for energy recovery or final disposal.	167.40-248.00
Concrete under 150 mm Asphalt Bricks	Concrete waste that has been crushed to a grain size under 150 mm. Demolition waste from roads and similar asphalt structures. Must not be contaminated by petroleum products. Construction bricks resulting from the demolition of buildings.	31.00-62.00
Construction rock material	Reusable rock material such as plastering and chiselling waste.	49.60-167.40

Impregnated wood	Impregnated wood, may not contain soil.	347.2
Soil and rock material	Excavated soil that can be utilized as it is on a landfill or in construction. Including blasted rock. Concentrations of contaminants below the lower guide values of the PIMA regulation.	0.00-37.00
Soil and rock material must be pre-processed	Soil and rock material (including liquid soil and rock material delivered by tank truck) containing a maximum of 10% of other waste by volume. Includes invasive species mixed with soil.	49.60-167.40
Contaminated soil that can be cleaned	Soil contaminated by contaminants exceeding the PIMA regulation's upper guide values. <i>If a recovery option cannot be assigned to soil purified by HSY at reception, landfill tax is (70 €/ton) added to the prices.</i>	12.40-248.00
Waste containing asbestos	Final-disposal waste. Building material containing asbestos	254.2
Insulation wool Sandblasting sand Soil and rock material, final-disposal waste Glass	Glass and rock wool. Final-disposal waste. Used sandblasting sand. Final-disposal waste. Landfillability required. Soil and rock material that cannot be reused but is landfillable. Glass for final disposal	223.2
Gypsum	Clean and dry gypsum boards, no refuse sacks, slabs, and wooden constructions or metal.	62
Leaves and garden waste, brushwood	Leaves, grass, plant tops, chipped or unchipped brushwood and other biodegradable garden waste. Including untreated sawdust. Tree branches and twigs. Including invasive species populations that do not contain reproductive plant parts (seeds, roots, etc.). May contain soil and rock material.	min. 24.80- max. 74.40
Street cleaning waste	Grit swept from the streets.	62.00-86.80

Overall in 2019, the Ämmänsuo accepted 354,024 tons of waste, which composition by type of treatment/allocation on the site include: composting, waste-to-energy plant slag treatment before recovery, land and concrete treatment before recovery, land in environmental structures, interim storage, processing activities, old landfill structures, treatment of contaminated land before recovery, hazardous waste landfill, landfill structures, landfill disposal, aggregate sludge clarification basin. (Figure 18).

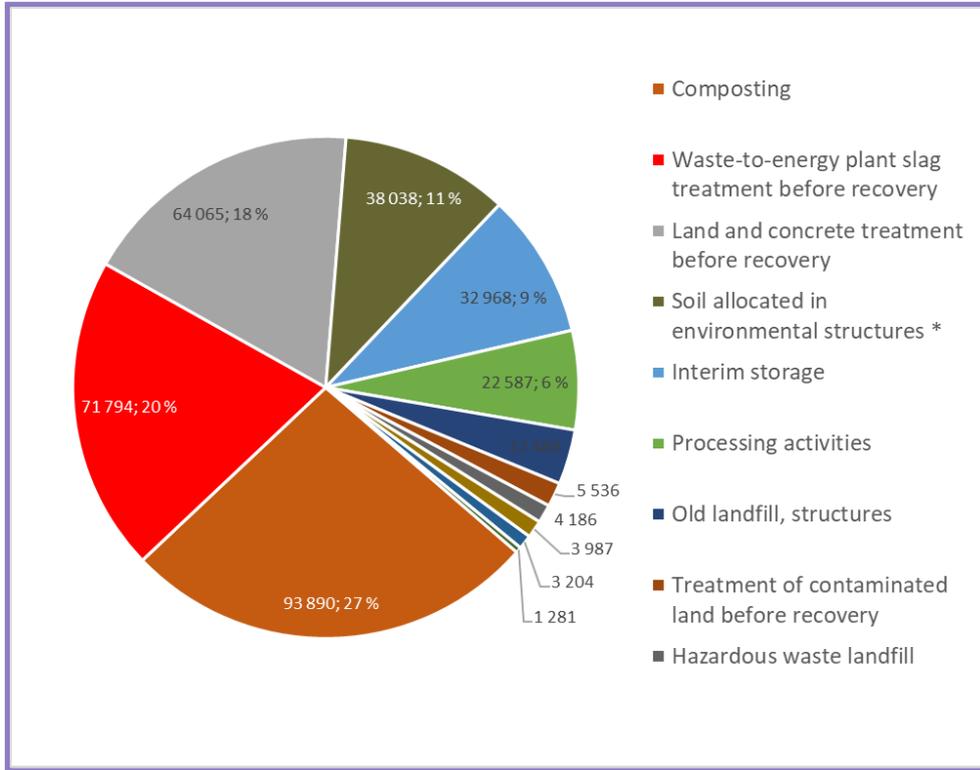


Figure 18. Accepted in HSY Ämmänsuo eco-industrial centre waste by treatment/acceptance site.

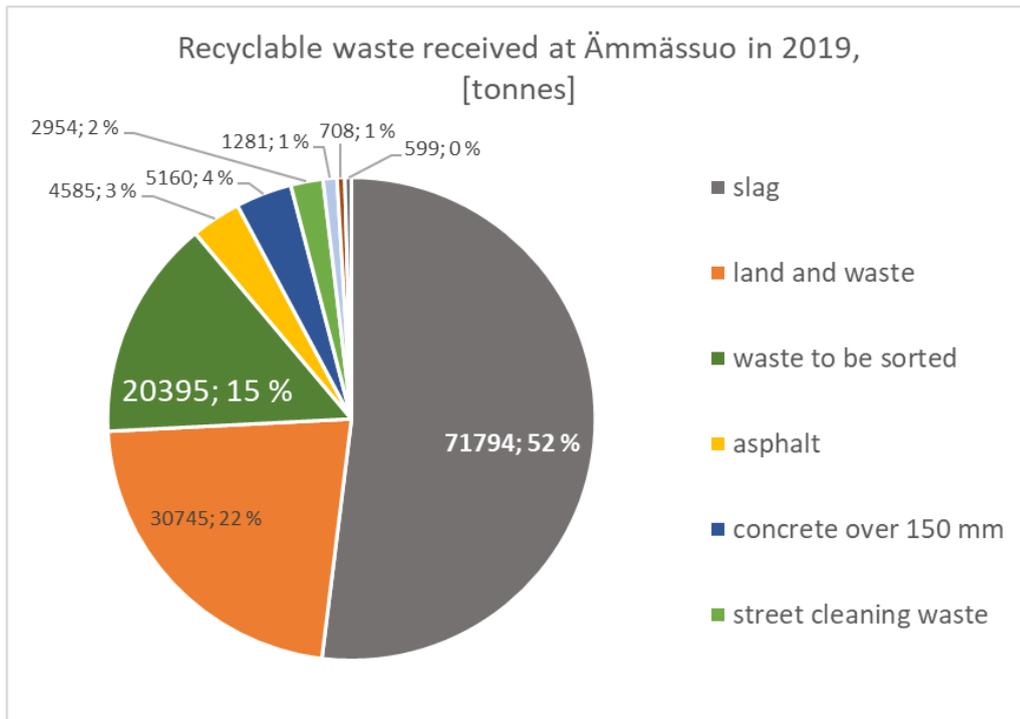


Figure 19. Recyclable waste received at Ämmässuo in 2019.

HSY is developing the **EKOMO ecosystem for business collaboration** based on industrial symbiosis and resource wisdom with circular economy companies in the region. Ekomo activities are mainly carried out in the area of the Ämmässuo eco-industrial centre, including material flows such as *biomass, recycled concrete and aggregates, and construction and demolition waste (CDW)*. In addition to Ämmässuo, EKOMO operations are also being developed at Kivikko (Helsinki) and Seutula (Vantaa).

HSY aims to create a diverse network of companies implementing a circular economy in the region where new ones are being developed by piloting, testing and processing, inter alia, industrial material and by-product streams and biowaste.

Several companies operating in the Ekomo area, e.g.:

- NCC Industry Ltd.'s asphalt plant utilizes, e.g. recycled asphalt and aggregate from the quarry as raw material.
- Delete Demolition Ltd. handles demolition of concrete and manufactures DeleKivi® recycled aggregate, the raw material for which is **concrete and brick waste** from building demolition or the concrete industry.

- Lassila & Tikanoja Ltd. has a transshipment station that enhances the logistics of CDW and energy waste, cardboard and recycled wood, asphalt plant, that utilized as raw material, e.g. **recycled asphalt and aggregate from quarry;**
- Fortum Corporation receives and **temporarily stores horse litter and mixes sawdust or recycled wood chips** into it. Fortum will supply HorsePower biofuel for use in power plants.
- Remeo Ltd. has **a transshipment station, which enhances the logistics of CDW and recycled wood.**
- Companies that utilize compost **pick up the compost produced at Ekomo in Ämmässuo and use it, for example, in their soil production** in the Helsinki metropolitan area.
- In 2021, HSY and Stena Recycling Oy started cooperation in Ekomo Ämmässuo centre. Stena rented 1.8 hectares of land for the recycling operations. Stena will build a service unit in the area, where **various metals, WEEE and ELVs will be received, processed and temporarily stored.**

In 2020, Ekomo operators received 107.300 tons of various waste fractions in Ämmässuo for material and energy recovery, almost double the number compared to 2019. HSY received for treatment 54 600 tonnes of biowaste in 2020. HSY produced 4.527 million m³ of biogas and 9 743 MWh in 2020:

Collected landfill gas from the fields of HSY Ämmässuo eco-industrial is utilized for the production of electricity and heating energy.

HSY studied possibilities of utilization of slugs and ashes produced as side products from the incineration process at the Vantaan Energy waste-to-energy/WTE plant. A market survey on ashes treatment was prepared in 2020. All slag was used in the HSY's own or external construction objects. In addition, the slag was also used in concrete elements for supportive walls. [EL5]

According to HSY strategy, slag from the waste-to-energy plant is utilized in the asphalted field area of the extending landfill. In 2020 about 1.3 hectares of asphalted field area was finalized.

3.2 Metsäsairila: property-specific waste collection, three small waste stations and waste centre

All waste management operations are concentrated in the area of Metsäsairila's sorting and recycling centre. In 2020, Metsäsairila received a total of about 68 000 tons of waste. All properties in the City of

Mikkeli must opt-in for either the municipal waste transport service or self-deliver their waste to a local collection point.

Recycle waste generated by households must be sorted in property-specific waste bins as follows:

	Categories of waste to be sorted and collected separately				
Number of households on the property	Biowaste	Cardboard	Metal	Glass	Paper
Up to 4	X				As required by sections 49 and 50 of the Waste Act
5 or more	X	X	X	X	

Properties where biowaste is composted, are not required to sort biowaste for separate collection.

Recyclable plastic packaging waste generated by households must be separately collected on the property and self-delivered to the RINKI eco take-back points of EPR corporation for recycling in accordance with the producer's instructions. Non-recyclable plastic waste must be sorted on the property as mixed waste.

Waste under the EPR (such as WEEE and B&A) must be collected separately and self-delivered to a collection point organized by the EPR corporation.

Brushwood and untreated wood waste that is not disposed off on the property per waste management regulations must be delivered to a designated reception point.

Property waste bins must be emptied with sufficient frequency to ensure that the waste does not cause odour nuisance or other harm to waste transport, for example, and at minimum as follows:

Mixed and biowaste: maximum emptying frequency in summer (weeks 18 to 40) – once in 2 weeks and winter (weeks 41 to 17) – once in 4 weeks

Cardboard, metal, glass: maximum emptying frequency in summer – once in 8 weeks and winter – once in 16 weeks

The emptying frequency for mixed waste containers depends on the number of subscribed households and the capacity of the waste bins. The minimum capacity is 20 litres per person per week.

Various types of hazardous waste must be sorted and collected separately. Hazardous waste collected and stored on the property must be delivered to a designated collection point at least once a year.

Treatment types of waste collected by Metsäsairila:

Ø All mixed waste is transported to Leppävirta and Kotka for energy recovery on Riikinvoima Oy and Kotkan Energy Oy waste-to-energy plants. Shipping frequency is five days a week.

Ø Wood panels and clean wood are crushed at the sorting and recycling centre. After crushing, the materials are shipped out and used to produce energy.

Ø Concrete and brick waste and glass are stored and crushed at the sorting and recycling centre. The crushed material is used as pavement for roads and lots at the centre.

Ø Metals and WEEE are stored temporarily at Metsäsairila's sorting and recycling centre and shipped out for reuse as raw materials.

Ø Paper and cardboard are baled at the sorting and recycling centre in the baling facility operated by Encore Ympäristöpalvelut Oy. The materials are delivered to the paper industry for reuse.

Ø All separately collected biowaste and sewage sludge from the city's wastewater treatment plant is processed at the biorefinery into biogas. The end product is composted at the sorting and recycling centre's composting plant and used to produce various soil types for landscaping.

3.3 EKJH: property-specific waste collection, nine For Use -stations, Kukkuoinmäki waste treatment centre

In the South Karelian municipalities, **sorting of biowaste is mandatory in all permanent living properties and holiday homes**. People can order either a collection service for biowaste or compost it in a property-specific composter. There must be a waste bin and collection service for so-called dry waste (*kuivajäte*) in residential houses. (*This is equivalent to the mixed waste concept used in the other MWMO example cases*).

People can leave dry waste to local collection points in sparsely populated areas.

Properties located close to each other can use joint waste bins or implement so-called block collection.

Organizing **cardboard sorting is mandatory for all housing properties of at least 10 apartments**.

Organizing sorting of **glass packaging** and **metal** is mandatory for all housing properties of at least 20 apartments and sorting plastic packaging by 31.12.2021.

Pricing of waste management services in South Karelia by the MWMO "EKJH" has the following categories: dry waste (*kuivajäte*) (Obs. by the authors: meaning mixed waste by the analogy with other regions), biowaste and recyclable waste (*hyötyjätteet*). The emptying fees of dry waste are the same for properties of households and institutions, but they vary between municipalities within the EKJH operational area. And, logically, the emptying prices of smaller bins are lower than more giant bins. Prices in the Cities of Lappeenranta and Imatra are almost identical – from €5.4 to €10. In Parikkala, Rautjärvi, Ruokolahti area, the fees are from €7.7 to €12.3 (Figure 20).

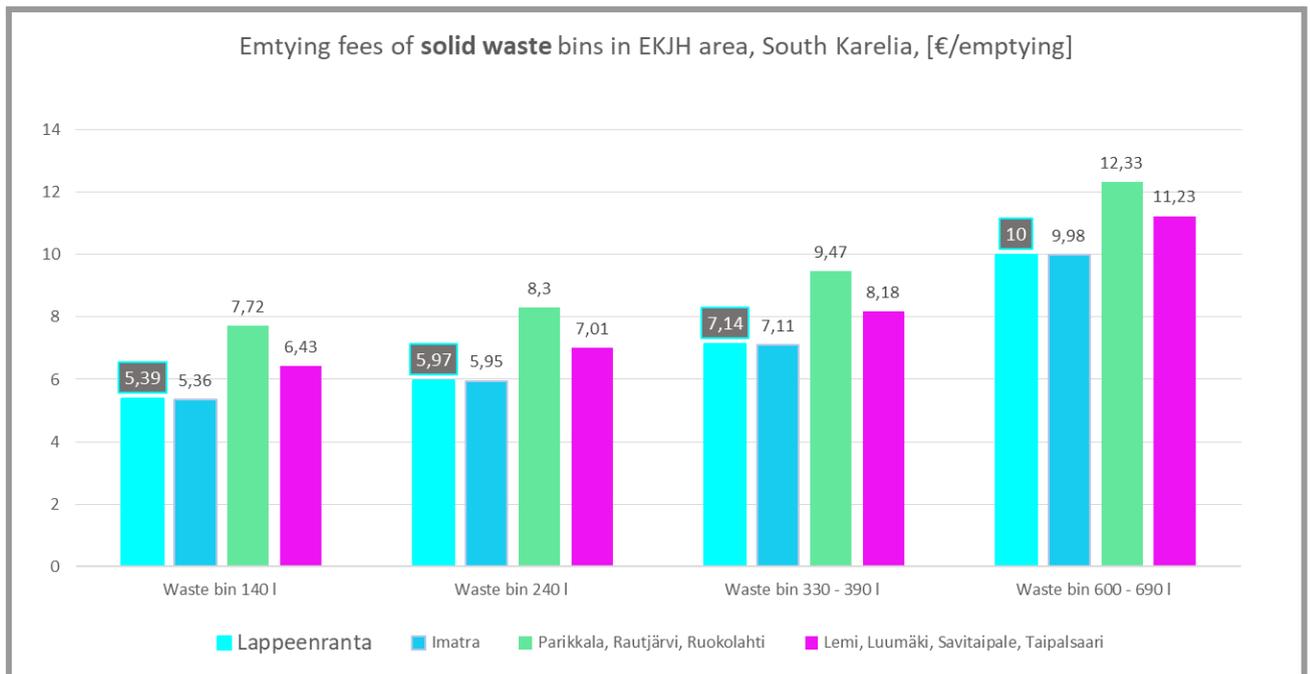


Figure 20. Pricing of emptying of solid/mixed waste by EKJH in 2021.

The pricing of EKJH for emptying biowaste bins is different for housing and institutional properties. For example, in the City of Lappeenranta, for households emptying of 240 litres bin costs about €9.5, but for institutional properties €15.8. Variations of the fees between the municipalities are also occurring, as in the case of solid/mixed waste. The prices in Parikkala, Rautjärvi, Ruokolahti are the highest – emptying of 240 litres bin cost from about €14 for households to €20.3 for institutional properties for which the fees are from €7.7 to €12.3 (Figure 21).

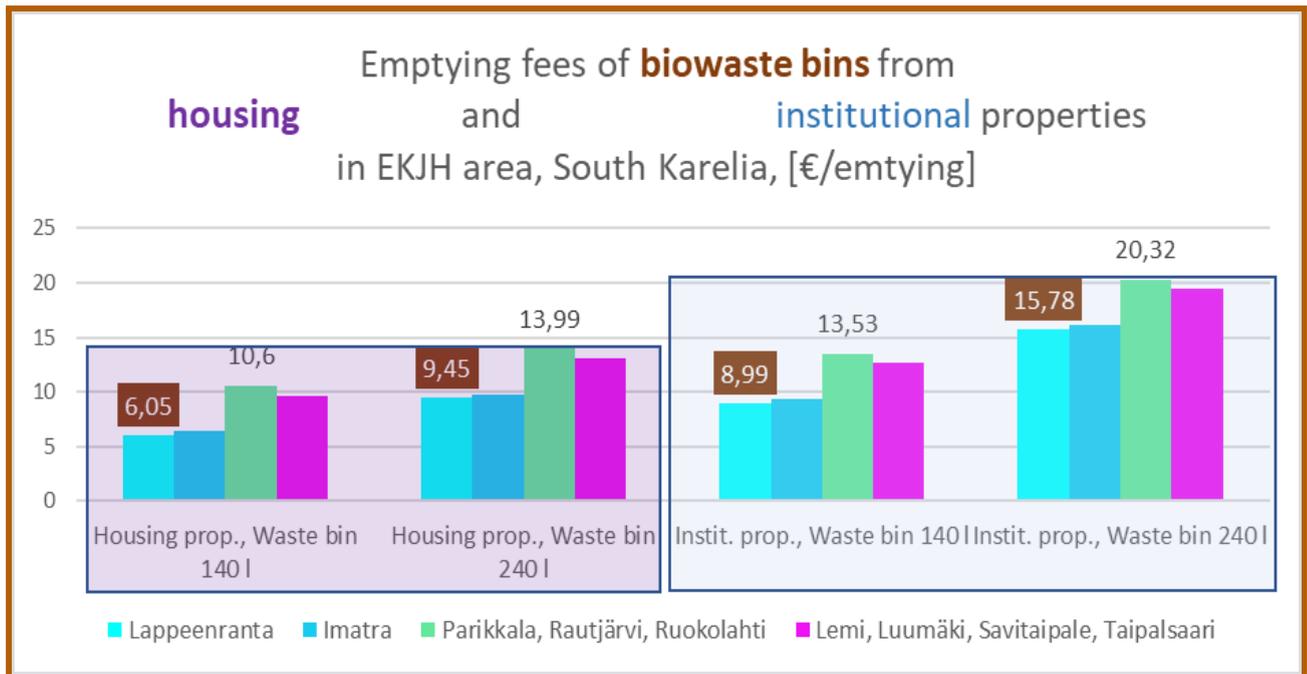


Figure 21. Pricing of emptying of biowaste by EKJH in 2021. Prices:

<https://ekjh.fi/hinnasto/jateastioiden-tyhjennyshinnat/>

Typically, a detached house has 240 l dry waste bin and 140 l biowaste bin and apartment buildings (one or more depending on the number of inhabitants) 660 l dry waste bin and 240 l biowaste bin.

In addition to the emptying fees, EKJH is also charging households so-called annual (or basic) payments, which example from the City of Lappeenranta is described in Table 9.

Table 9. Basic fees of EKJH in 2021.

Annual fees in Lappeenranta:	Basic fee, EKJH part	Municipal add.	Authority fee	Annual fee, TOTAL
Apartment in block of flats	15,4	3,5	2,24	21,12
Apartment in terraced and semi-detached house	17,3	3,5	2,24	23,04
Detached/one-dwelling house	18,2	3,5	2,24	24,00
Vacation home	13,6	2,3	2,24	18,18
Detached house empty/non-inhabitant	13,6	2,3	2,24	18,18

Suppose some property does not agree on waste bins emptying with EKJH. In that case, it must deliver accumulated property-specific waste to a local waste collection point organized by the MWMO and pay the annual fee for this service. In the City of Lappeenranta, such a fee is about €68.7 for a year-round permanent home apartment (a lower fee of €48.2 for a one-person apartment) and about €43 for holiday homes and non-inhabited permanent living apartments. For the wrong usage of the local waste collection point, EKJH is charging €150.

EKJH is selling waste bins to the customers. Prices including VAT, delivery, labels and old bin are taking off: €61 for 80 – 240 litres bins, €103 for 360 l bins, €190 for a new 600-660 l bins (€120 for used). Multi-compartment waste bins cost €215 for 360 litres and €353 for 660 litres. Renting option is also available: €2 per 360 l and €5.5 per 660 l. Customers can also buy waste bins without delivery service, in which prices are lower. For example, 600-660 l bin cost €175 (vs €190 in the case of delivery service included).

In every municipality of South Karelia, there is at least one **For use (Hyödyksi)-station**. In the City of Lappeenranta, there are three For use stations: in Toikansuo and Kukkuroidmäki waste management centre and in Ylämaa small For use station, which is open once a month.

Prices for waste reception on For Use stations or self-delivered waste by customers to sorting station of the EKJH:

- Small amount (max. 20 l) of housing waste: €2
- Housing small amount in 200 l packaging of CDW, solid waste, energy waste: €15/m³
- Delivered by private car (peräkärärykuorma) over 2 m³ of CDW, solid waste, energy waste: €25/m³
- Biowaste max. 20 l bag: €2
- Runko- ja joustinpatjat: €8 per unit
- Furniture (e.g. sofa, armchair): €12
- Gardening waste (traktorin peräkäräryllinen tai kuorma-auton lavallinen): €35
- Tynnyrin hävitysmaksu: €35

Pricing is based on the volume of the waste; in Kukkuroidmäki price is lower than in other stations because there is no need for transportation. Citizens can bring their garden waste, hazardous waste, electric devices and scrap metal free of charge to For use stations. For example, a trailer loaded with priced waste costs 15€ in Kukkuroidmäki and 25€ in the other stations. In 2020 more than 12000 customers visited Toikansuo For use station.

For packaging waste, there is also an organized good eco station network. South Karelia and South Karelia Waste Management Center have their collection points that supplement the collection network of RINKI eco take-back points. Cardboard, glass packaging is collected in all collection points and For use stations and plastic packaging waste on most of them.

In Lappeenranta, there are 19 RINKI eco take-back points provided by EPR corporations and 11 eco points of the MWMO. In addition, the MWMO has organized a collection of plastic packaging at three RINKI eco take-back points, where there is no plastic collection available.

4. Variations between municipality- and property-specific fees of some waste fractions within operational areas of MWMO case examples

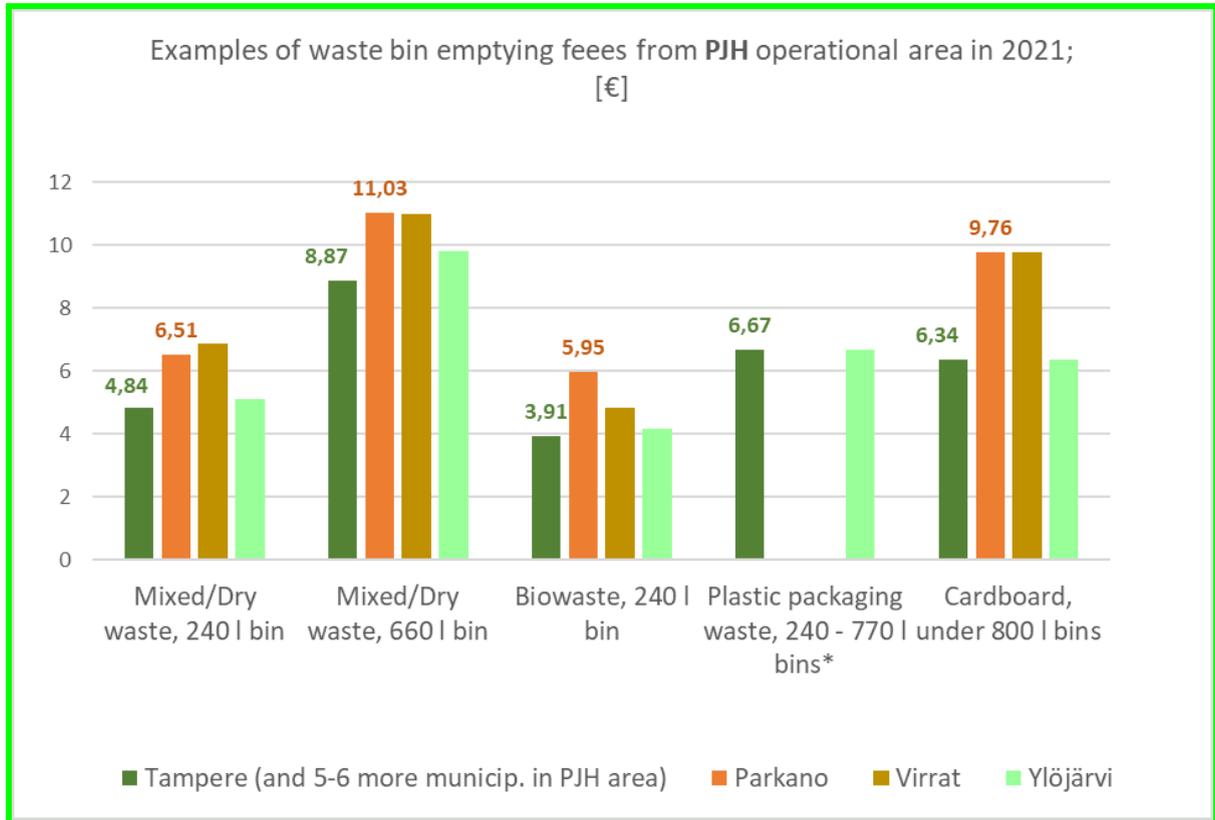
Five MWMOs with different municipalities in the MWMO's operational area have been selected to observe variations in pricing strategies.

For observing **municipality-specific fees** are selected case examples:

- PJH: 17 municipalities
- EKJH: 9 municipalities
- Kiertokapula: 13 municipalities

Figure 22 presents some examples of fees from some municipalities in these three examples. The principle of selection was to showcase different municipalities in terms of population density and proximity to waste treatment facilities. For example: Tampere vs. Parkano, Lappeenranta vs. Parikkala, Hämeenlinna vs. Tuusula. For generic showcases, emptying fees of some waste fractions and volumes

of waste bins are selected. Such volumes are up to **240 l bins for mixed/dry** and **biowaste, 660 l bins for mixed/dry waste**. As shown from Figure x, categories of waste bin volumes vary.



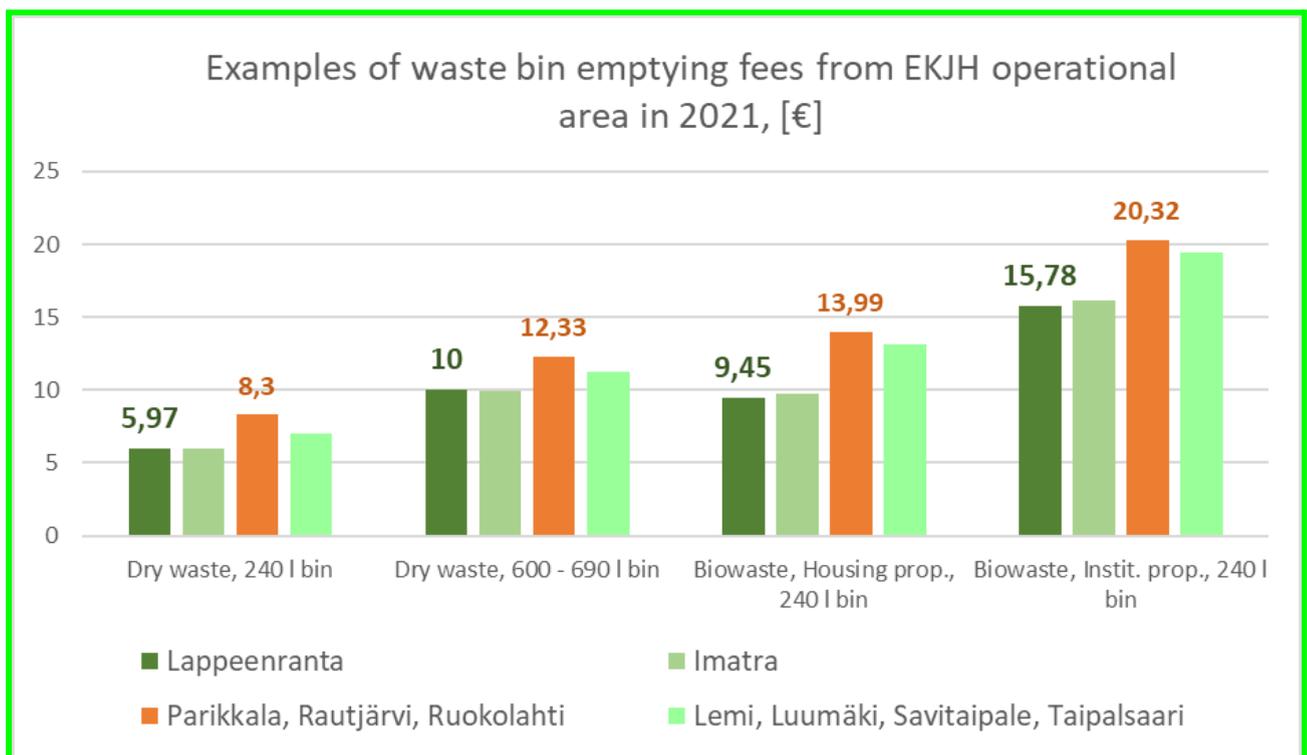
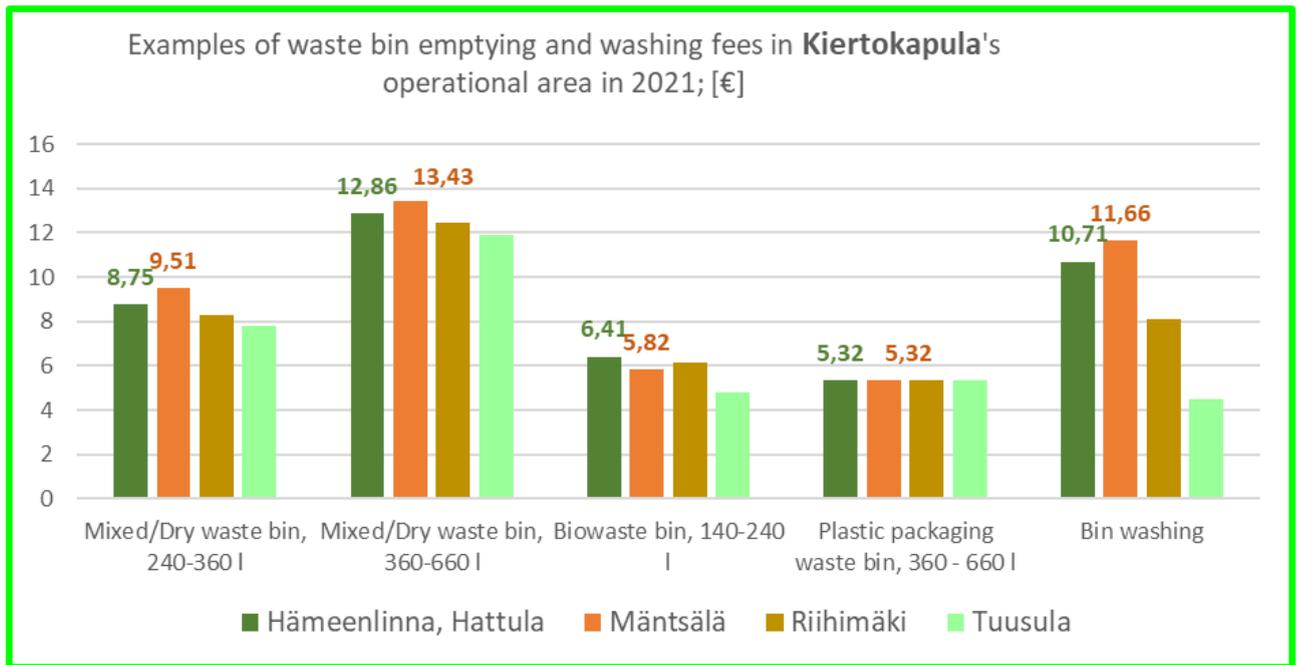


Figure 22. Examples of municipality-specific pricing strategies of 3 MWMOs - PJH, Kiertokapula and EKJH.

In the HSY case, the pricing is the same for all five municipalities within the operational area but varies for different waste fractions. Figure 23 showcases examples of fees. For more generic overviews, once a week emptying fee category is selected.

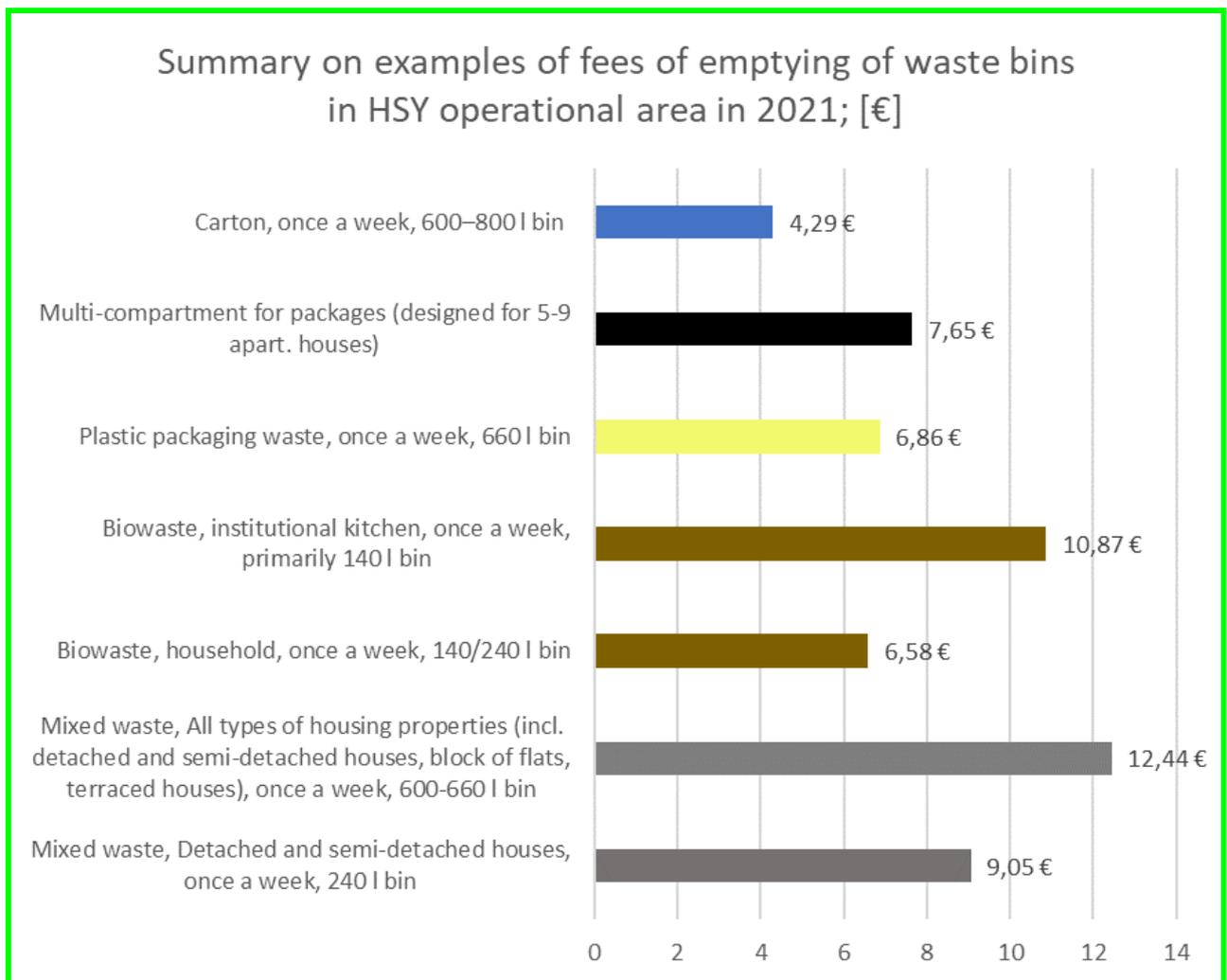


Figure 23. Waste fraction-specific pricing in the HSY case.

Observing waste **fraction-specific pricing** is conducted for five MWMOs cases. In prominent overviewed case examples, evident interdependence between charges in different waste fractions is not seen. For example, the charges for emptying mixed and cardboard waste in Tampere are 8.87/6.34, in HSY 12.44/4.29. Relations between charges for emptying of **mixed** and **biowaste** bins: in Mäntsälä is 13.43/5.82, in HSY 12.44/6.58, in Metsäsairila is 13.00/8.5. Summary overview on the pricing of mixed waste and biowaste by five MWMOs is presented in Figure 24.

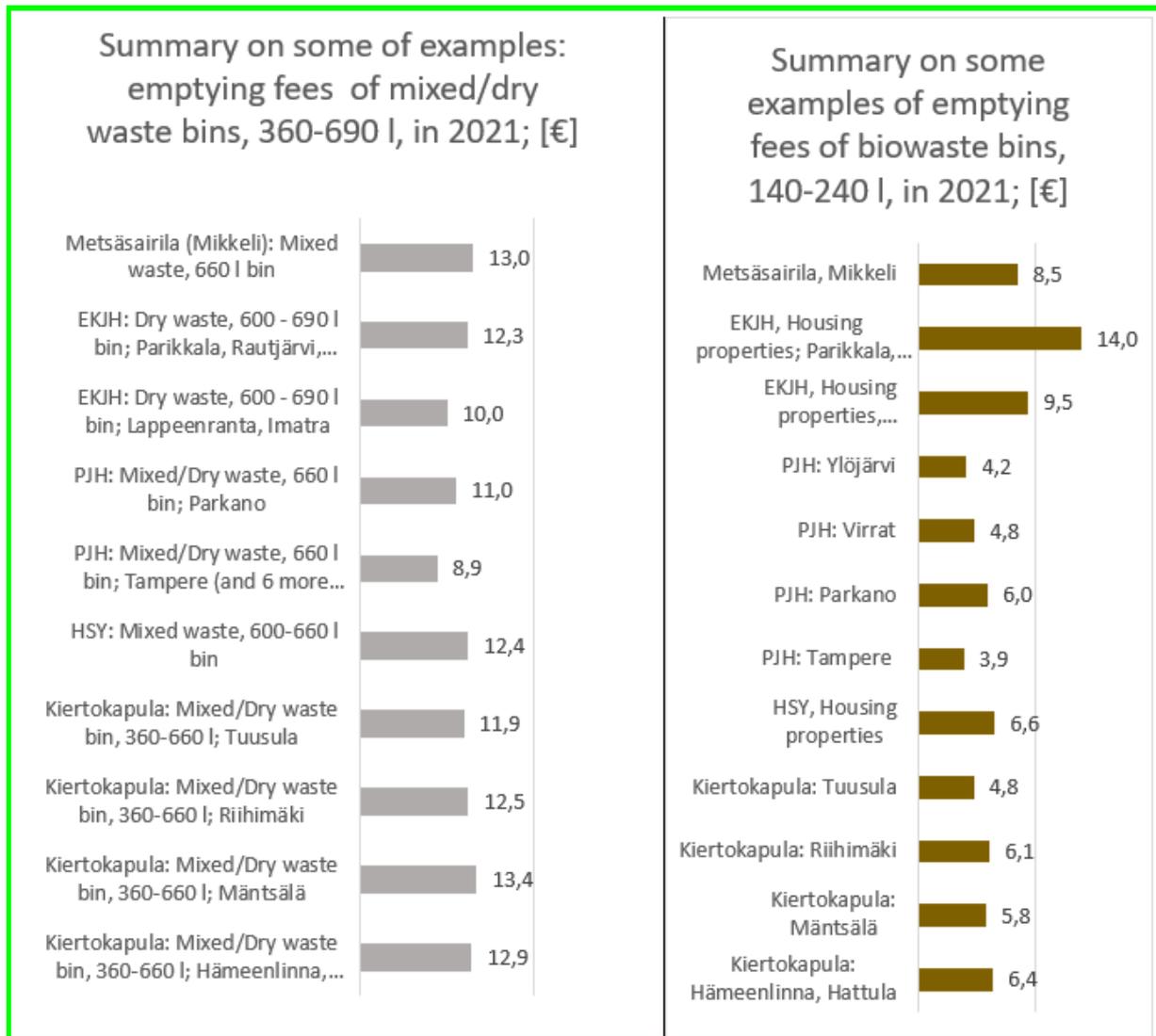


Figure 24. Summary on mixed vs biowaste pricing of five MWMOs.

Gradation of mixed/dry waste bins volumes under the same fee category varies in different MWMOs. For a more generic overview, all comparable examples in Figure z include 660 l volume of waste bin. In the MWMO case, examples fees vary from €13.4 (MWMO Kiertokapula, for the municipality of Mäntsälä) to €8.9 (MWMO PJH, for City of Tampere and six more municipalities within the operational area). Generally, fees for collection of biowaste have a category of 140-240 l of waste bin. Variations in fees within MWMO case examples are much broader than for dry/mixed waste – from €14 (MWMO EKJH, e.g. for households in the municipality of Parikkala) to €3.9 (MWMO PJH, for Tampere). (Figure 24).

5. Waste transportation in the economy of MWMO in the light of HSY case example

Waste transportation owns a major part in the waste management turnover of HSY – accounting for 80% of operating income and 47% from purchased services. Or 77,325 million € of income and 30,292 million € of expenses. (Figure 25).

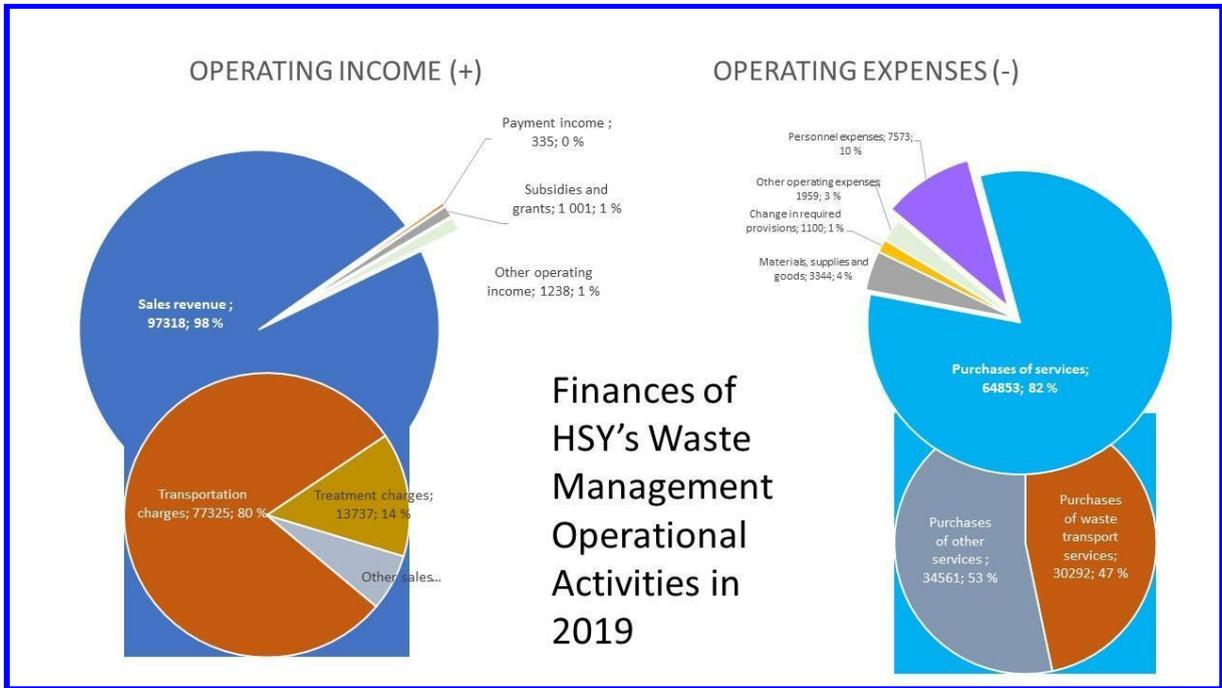


Figure 25. Finances of HSY in 2019.

In 2019 in total were 81,155 transportation agreements under HSY's waste management operations – including over 26,000 of those in Helsinki, about 23,500 in Espoo, about 22,000 in Vantaa. Part of those agreements is joint agreements (*kimppakeräys*).

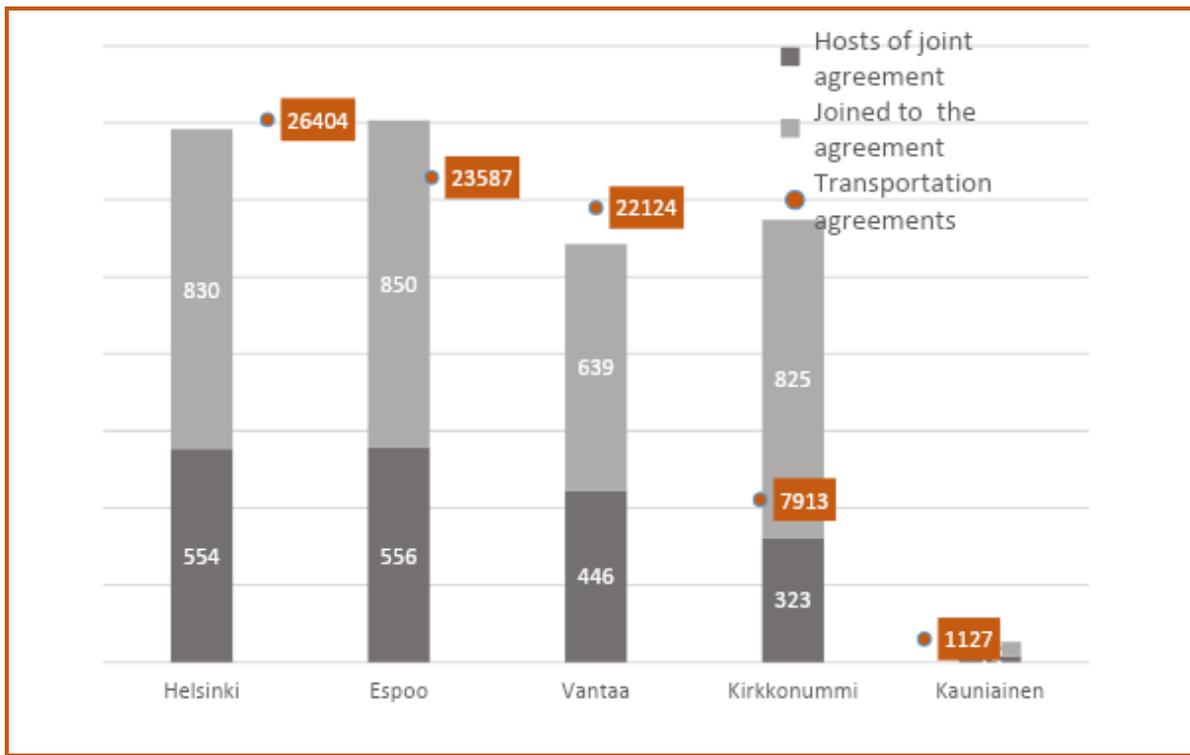


Figure 26. Transportation agreements of HSY in 2019.

There are about 140 garbage trucks emptying waste from households in the HSY area. HSY tenders transport contracts for 5 years. Requirement of using non-fossil fuels in all tenders for waste transportation contracts.

In 2019, HSY organised waste transportation in collaboration with twelve subcontractors: Lassila & Tikanoja, Remeo, Urbaser, Tapiolan Lämpö, Sihvari, Kuljetusliike Piharatamo, Grönfors Training, Tumik, Eerola, L&T Liete, Espoon KTK and Espoon Maansiirtopalvelu. (Figure 27).

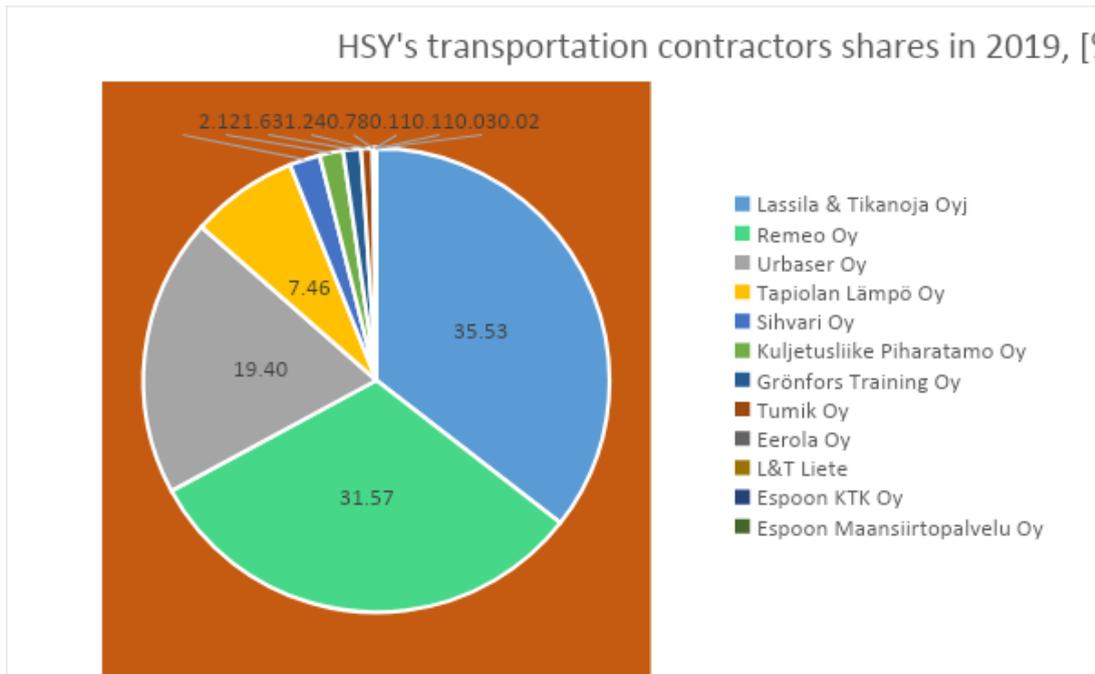


Figure 27. HSY's transportation contractors in 2019.

HSY controls transport emissions through:

- ❖ route planning
- ❖ paying attention to the euro classification of equipment fuel
- ❖ experimenting with a multi-compartment waste bin.

HSY is experimenting with multi-compartment waste bins with small properties (detached and semi-detached houses) and started collecting packaging waste on properties with 5-9 apartments during 2021. Properties don't need to use such multi-compartment bins. It is more of an opportunity provided by HSY.

In 2020 about a thousand detached houses and a few terraced houses participated in the multi-compartment experiment. The traditional mixed waste bin was replaced by four-sectioned bins, including a separate part for plastic packaging, biowaste, **and metal**. A waste truck was designed to empty all compartments at once to the corresponding trays. In this way, the types of waste were kept separate, and the raw materials were obtained for recycling. HSY is attempting multi-compartment collection to improve the recycling rate of waste in the smaller properties and reduce mixed waste amounts.

6. Collaboration of MWMOs and local Reuse Centres in the light of Helsinki Metropolitan area and Mikkeli region examples

6.1 "Kierke" Reuse Centre's collection point on HSY Sortti stations

HSY collaborates with *Helsinki Metropolitan Area Reuse Centre* (origin name: *Pääkaupunkiseudun Kierrätyskeskus*) within Sortti Stations. At all, HSY Sortti Stations are Reuse Centre's collecting points for small household items that are still fit for use. However, if customers are exclusively delivering items still fit for use, they are guided to deliver them directly to the Reuse Centre's reception points. Acceptance on such still fit for use household items could be seen as additional service at the Sortti Stations, not the main.

Accepted for Reuse Centre collection:

1. usable and intact small household furniture and storage units (no reception during the coronavirus pandemic)
2. clean carpets
3. small items, such as books, CDs and vinyl records, tableware, clothing, shoes
4. sports and hobby equipment
5. bicycles in any condition
6. flat-screen televisions, including defective ones as long as the screen is intact (repaired or used as spare parts)

Not accepted for collection

- large furniture items
- electric and electronic equipment
- bicycle, motorcycle, ski and riding helmets
- child seats for cars and bicycles
- climbing safety gear (climbing harness and additional equipment)

In addition to bigger sorting stations, there are also new mini-stations taken into operation (in November 2021), located in connection to the Reuse Centre (*Pääkaupunkiseudun Kierrätyskeskus Oy*).

6.2 Recycling and sorting center KIEPPI in Mikkeli – example of collaboration Mikkelin Toimintakeskus & Metsäsairila



Photo collage: KIEPPI and Metsäsairila site, Mikkeli;
10.12.2021

In February 2021, a new recyclable goods reception and a sorting hall were built in the Mikkeli Ecosairila area, to which residents can deliver all surplus goods and materials from their households. The hall was built as a joint project between the waste management company Metsäsairila Oy, Mikkeli communal development company, Miksei Oy and Uutta elämää Group. The project was named EcoSairila - a centre for recycling and green business. The sorting hall was named KIEPPI.

At the start of KIEPPI Hall activities, Uutta elämää Group accepts goods and materials suitable for reuse. The continuing life of any usable goods is prolonged at another branch of the association through maintenance and repair measures. The life span of the materials is extended by using them for manufacturing recycled products. Metsäsairila, on the other hand, is responsible for waste management of materials that cannot be reused as such on the other side of the hall.

The cooperation model promotes materials recovery and encourages *Uutta elämää* Group employees to obtain more material information, among other perks. Kieppi has created a new recycling economy learning environment associated with the New Work and Expertise in the Circular Economy -project (ESR). Further development of the operative model will be continued in the Cool4City -project.

7. MWMOs in material and energy recovery value chains – examples of biogas and waste-to-energy value chains

7.1 HSY biogas production and involvement in the waste-to-energy value chain

Biowaste treatment into biogas, digestate and compost in the Helsinki metropolitan area happens in **HSY's Ämmässuo eco-industrial centre** (for overall description, see Chapter 3.1). Figure 28 presents a site for the treatment of organic waste and info on products (Source: Christoph Gareis. HSY; presentation on 26.8.2021)

The results of treatments are quality controlled compost (an annual amount of about 15 000 tonnes) and biogas (annual amount is 5.5 million m³).

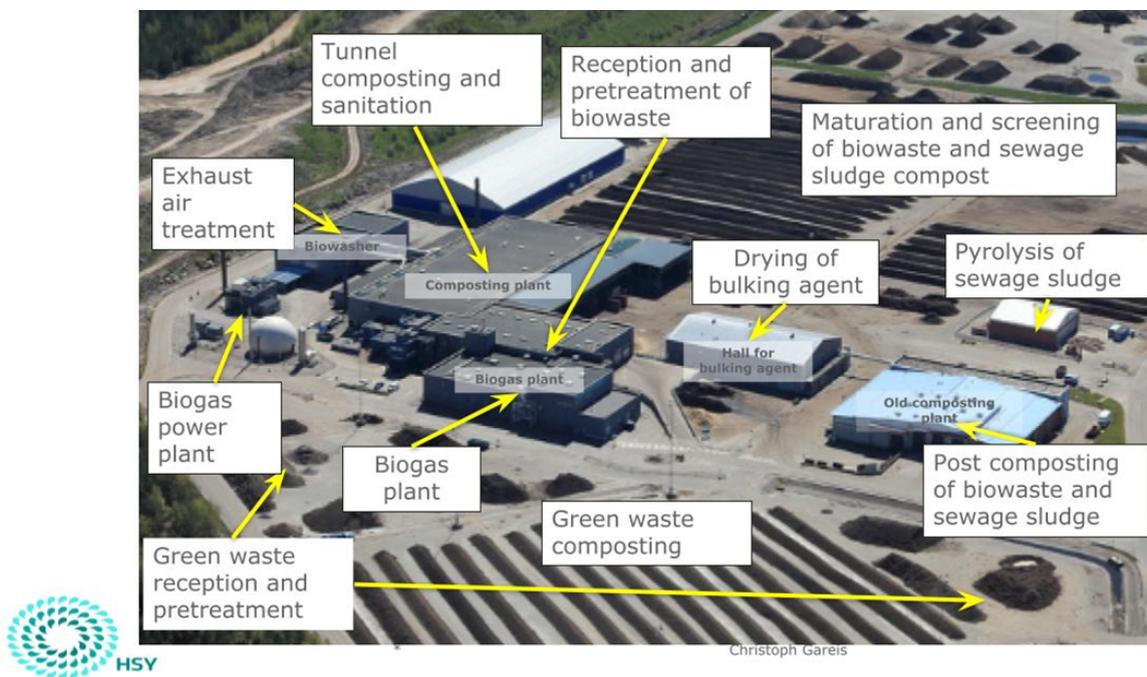




Figure 28. Site for the treatment of organic waste in HSY's eco-industrial centre Ämmässuo.

HSY's Ämmässuo site received about 42.000 tons of biowaste via property-specific separate collection (Figure 7) in 2019. In addition to this source, HSY also treats compost of approximately 5000 households and organic waste from the food industry, retail, restaurants and kitchens (annually 0-20 000 tonnes).

Waste-to-energy value chain in Helsinki metropolitan area involving three main organizations – local energy company **Vantaan Energy** (owned by municipalities of Vantaa and Helsinki), waste management organization **HSY** (association of four municipalities – Helsinki, Vantaa, Espoo and Kirkkonummi; the population in this region) and waste management organization **Rosk'n Roll** (owner municipalities are Lohja, Raasepori, Vihti, Hanko, Karkkila, Inkoö and Siuntio in Western Uusimaa and Porvoo, Sipoo, Loviisa, Pornainen and Askola in Eastern Uusimaa; the population in this region is 230 000). Visualization of the value chain is presented in Figure 29. A business model of collaboration is quite simple, which is based on three points:

1. Waste collectors and transporters HSY and Rosk'n Roll are paying so-called gate fees to Vantaan Energy
2. Vantaan Energy sales produced electricity to open markets via the national grid.
3. Vantaan Energy sales district heating to properties connected to Vantaan Energy's network

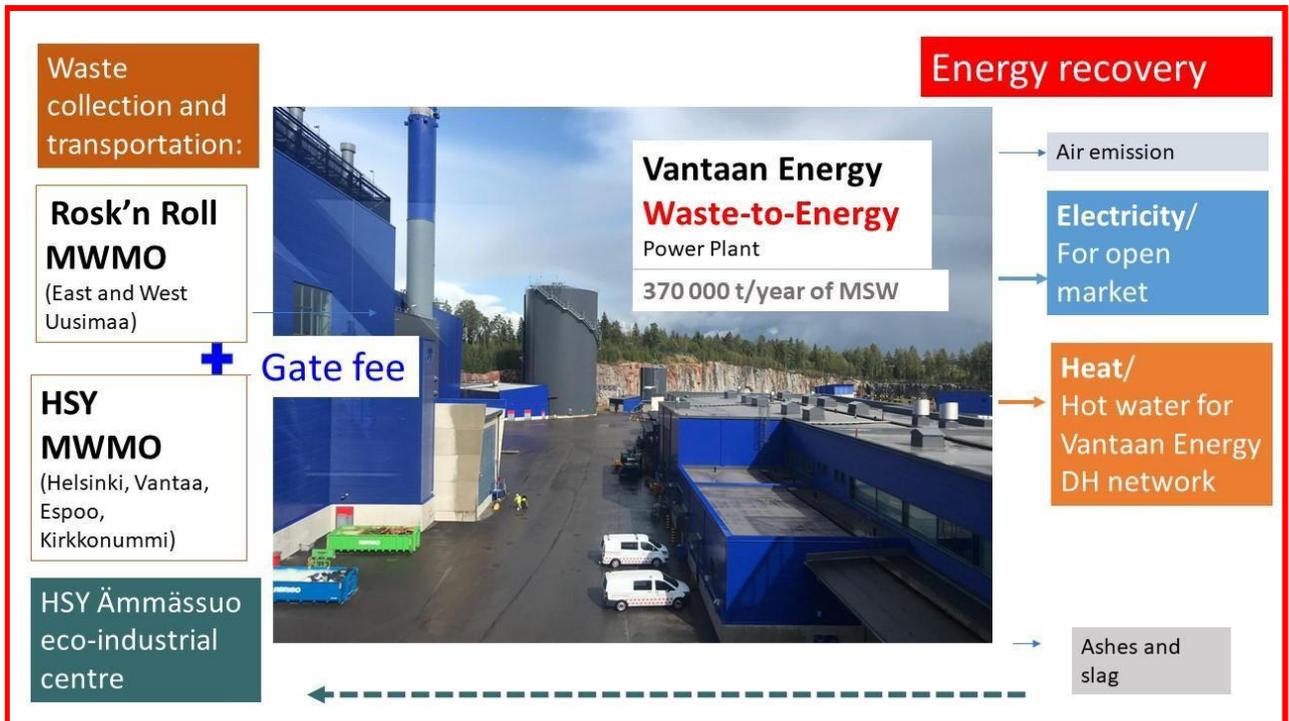


Figure 29. Waste-to-energy value chain in the Helsinki Metropolitan area.

7.2 Mikkeli region biogas ecosystem

There are three biogas plants in operation in the Mikkeli region: Juvan Bioson, BioHauki and BioSairila. Commissioned in 2020, BioSairila Ltd. is owned by MWMO Metsäsairila and local energy company ESE, uses wastewater treatment plant sludge, biowaste from households and companies, garden waste, agricultural side streams and grass silage as feedstock. Commissioned in 2017, BioHauki Ltd. is owned by the ESE and local farmers, producing 700 tonnes of biomethane annually. The third, oldest biogas plant was commissioned in 2011 Juvan Bioson, owned by local farmers, produces 1400 MWh of electricity annually and 2000 MWh of heat. Biogas produced in the Mikkeli region is distributed via three local biogas filling stations. (Figure 30)

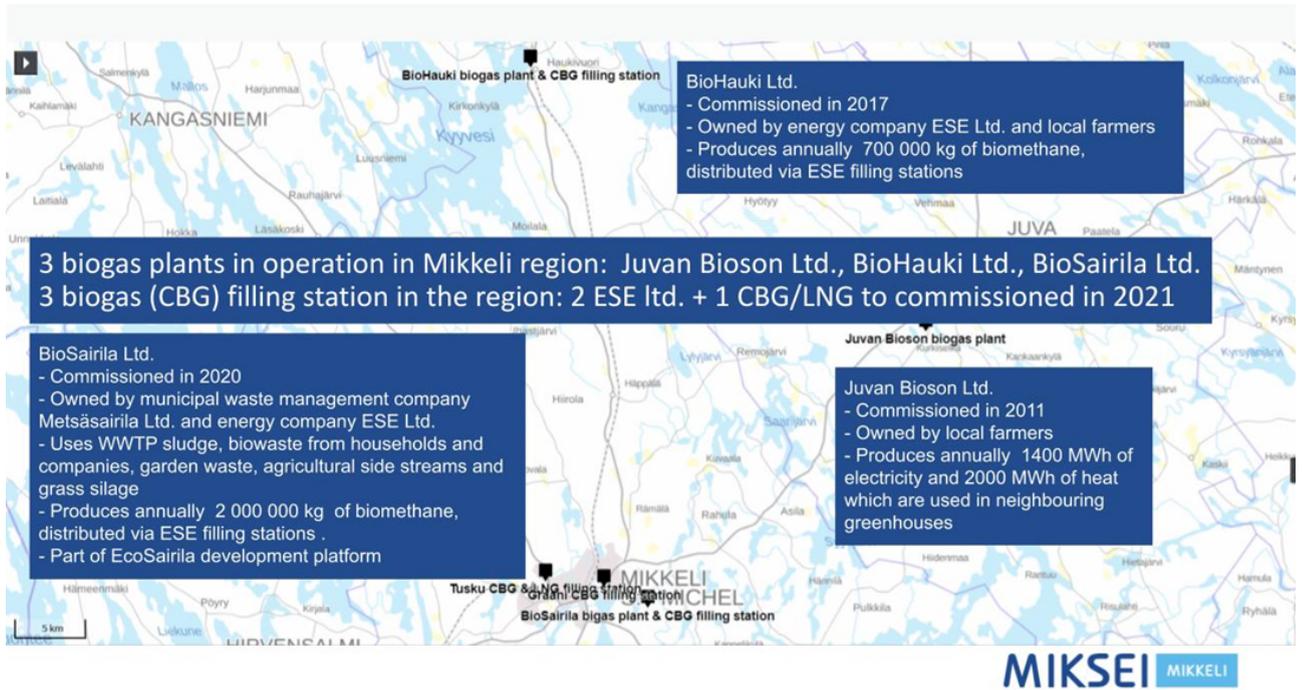


Figure 30. Mikkeli region biogas ecosystem.

7.3 Biogas plant of EKJH in Kukkuoroinmäki treatment/eco-industrial centre



The biogas plant at Kukkuoroinmäki eco-industrial centre in South Karelia is owned by the MWMO of EKJH. The plant was commissioned in 2020. The plant uses biowastes and sludges as feedstock. Produced biogas is upgraded to methane to be used as fuel. The biogas plant project was a significant investment for the EKJH, which also helps owners-municipalities to achieve their environmental goals. The project received a € 2.2 million grant from the Ministry of Employment and the Economy of Finland for renewable energy production. The Kukkuoroinmäki biogas plant is based on dry technology. The nutrient-containing liquid

generated in the process is utilized in land improvement and industrial processes. Land improvement products are processed from the solid treatment residue. The processing capacity of the biogas plant is 19 900 tons. The processed biowaste is about 6 300 tons and sewage about 13 600 tons a year. The biogas plant produces about 2.05 million normal cubic meters (Nm³) of biogas, 1,2-1,3 million Nm³ of methane and 12 300 MWh of energy in a year.
<https://ekjh.fi/biokaasulaitos/>

8. MSW management costs from housing company perspective in the light of the 60 m² apartment example

In the core of community/apartment housing in Finland are two legal entities – limited liability **housing company** (*asunto-osakeyhtiö/taloyhtiö*) and **hosting company** (*isännöintiyhtiö*). There are about 88,000 housing companies in total, from which about 50,000 buy hosting services from real estate management companies. There are about 1,200 such hosting companies in Finland. A housing company is a single legal entity owning all property, even apartments themselves. **Natural persons can own shares in a housing company**. As a general rule, costs in the housing company are distributed on a consideration basis per the Housing Companies Act. This means that the company's costs are distributed among the shareholders per the basis for payment per square meter or per share. The Articles of Association (*Yhtiöjärjestys*) define the basis on which the shareholders pay remuneration (*vastike*) and on which premises the shareholder's shares give the right to manage. It is also possible to find out from the Articles of Association how maintenance responsibilities are divided between the shareholder and the housing company. The general meeting of shareholders selects a Board of Directors, which has the role of operative director for the housing company. (Figure 31).

Usually, in practice, smaller properties, e.g. terraced or semi-detached houses with less than 10 apartments, do not have a hosting company but maintain and operate properties by themselves.

Community housing in Finland – in the core are **Housing** and **Hosting** Companies

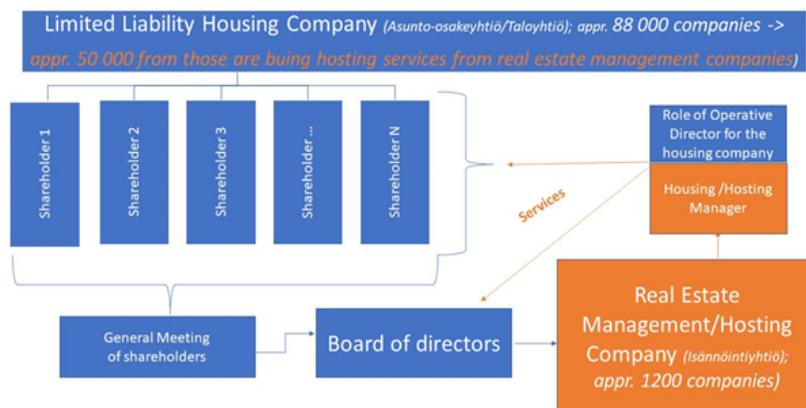
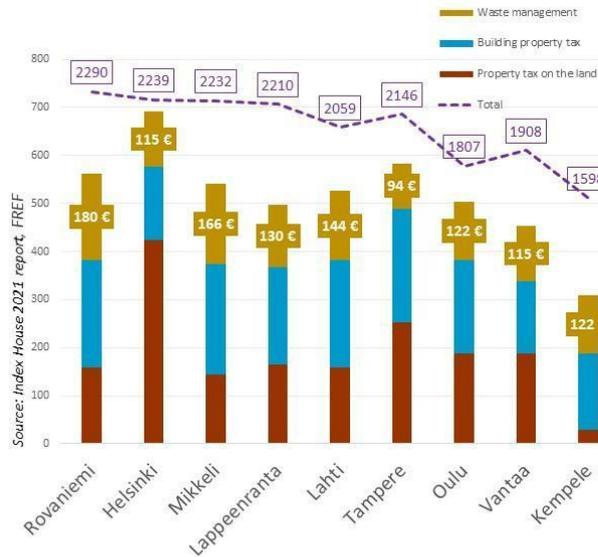


Figure 31. Management of community housing properties in Finland.

Waste management costs of housing are included in Statistics Finland (StatFin) and Finnish Real Estate Federation (FREF) data. Since 2001 FREF has annually compared property taxes and other housing costs (incl. waste management costs) of a block of flats (BF) in the biggest cities of Finland. The latest report (September 2021) covers 59 cities or municipalities. Housing costs in this FREF report are calculated for the so-called "index building", a block of flats located in the city grid, owned by the housing company land plot and has 10 000 m³ volume. Statistics Finland (StatFin) is compiling housing companies' economy data, which include a **block of flats (BF)** and **terraced houses (TH)**. StatFin's statistics of housing companies' economy is collected by the year of commissioning of properties and by the more prominent regions. FREF and StatFin are presenting costs in eurocents per square meter per month. For this report, to make some generic overview, housing costs are calculated annually for 60 m² apartments. (Figure 32).

Index House Real Estate Taxes, Waste Management and Total Payments 2021; Block of Flats (BF) - 60m² apartment, [€/year]



Waste management costs in housing company finance

Source: Finance of housing companies / StatFin



Figure 32. Variations of costs of housing companies. Sources: FREF and StatFin.

Calculation results of **annual costs in € based on FREF Index Building 2021 for 60 m² apartment in a block of flats in some cities within operational areas of MWMO case examples:**

	Property tax on the land	Building property tax	Waste management cost	Total housing costs [€]
Rovaniemi	158	223	180	2290
Helsinki	425	151	115	2239
Mikkeli	144	230	166	2232
Lappeenranta	166	202	130	2210
Lahti	158	223	144	2059
Tampere	252	238	94	2146
Oulu	187	194	122	1807
Vantaa	187	151	115	1908
Kempele	29	159	122	1598

Calculation results of **annual costs in € based on StatFin data from 2020 for 60 m2 apartment in a block of flats (BF) and terraced houses (TH) by year of commissioning of property:**

Year of commissioning of	Total costs of housing company		Waste management cost	
	TH, 60 m2/year	BF, 60 m2/year	TH, 60 m2/year	BF, 60 m2/year
-59	2290	3175	180	137
60-69	2930	3053	86	130
70-79	2398	2873	108	108
80-89	2153	2952	122	122
90-99	2261	3002	144	115
00-09	2023	2858	137	101
10-	2239	2765	144	122

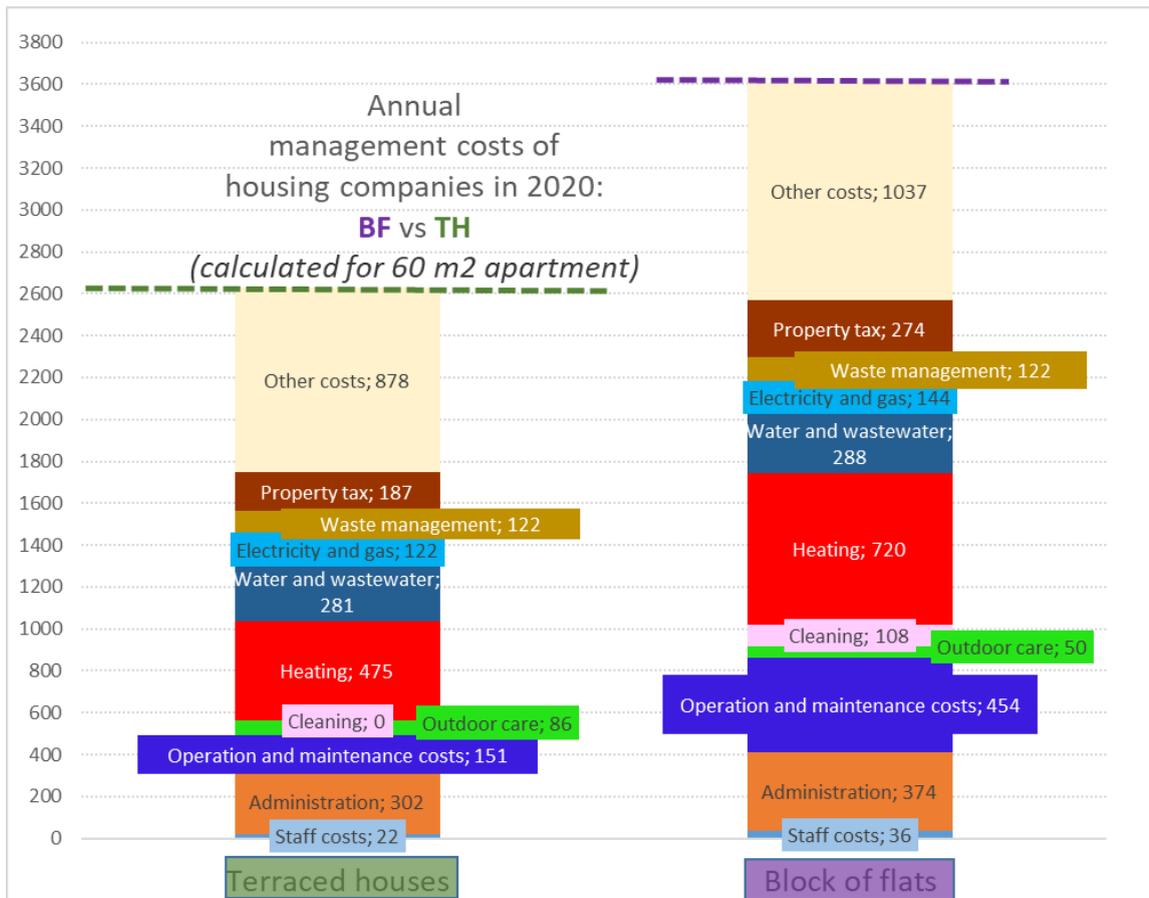


Figure 33.

Annual management costs of housing companies of a block of flats vs terraced houses. Source: StatFin.

According to another *StatFin* data in housing companies economy statistics by larger regions, total management costs of a block of flats are higher than of terraced houses. Calculated for 60 m² apartment meaning total expenses for a **terraced house (TH) is 2628 €** in 2020 and **3607 € for a block of flats (BF)** (Figure 33):

	TH	BF
Staff costs	22	36
Administration	302	374
Operation and maintenance costs	151	454
Outdoor care	86	50
Cleaning	0	108
Heating	475	720
Water and wastewater	281	288
Electricity and gas	122	144
Waste management	122	122
Property tax	187	274
Other costs	878	1037
Total	2628	3607

Waste management costs of housing companies in statistics of FREF and StatFin are **direct costs** or payments for collecting or emptying waste bins on the property site, possible renting and washing of waste bins, and a possible basic fee charged by MWMO. However, **indirect costs** related to property-specific waste of housing companies are part of the other costs, e.g. operating and maintenance, cleaning and taking care of outdoor areas. For example, the hosting company (*isännöintöimistö*) is also taking care of waste collection points, cutting trees, etc.

Housing properties can influence the amount of their direct waste costs by sorting, adjusting the number, size and emptying frequency of waste bins. For example: in a block of flats in Helsinki with 135 inhabitants, the property-specific waste management costs were reduced by 4000 € (from 10 000 to 6000 €/year in the year 2018) by optimizing the allocation of waste bins, reducing the number of waste bins and emptying frequency. As the collection of mixed waste is more expensive, it works as an effective economic instrument to reduce the amount of mixed waste. Changes made include decreasing the emptying frequency of mixed waste bins (five of them on the property) from 3 times a week to 2 times, adding one plastic packaging waste bin with emptying frequency once a week and decreasing paper bins from two to one. If to transfer this experience to 2021 and make calculations in 2021 prices, then savings would be more impressive: $5 \times 53 \times 3 \times \text{€}14.09 = \text{€}11,202$ but $5 \times 53 \times 2 \times \text{€}13.01 = \text{€}6,895$, so only by adjustment of the frequency of emptying of mixed waste bins savings of €4,307 would be achieved.

In addition to the positive impact on the economics of property owners, optimization of property-specific waste point arrangement and management also has a positive environmental impact, e.g. decreased emissions from waste transportation. Only in one case example described above are 53 transportations/stops of waste track needed.

Another real-life example is the housing company of flats with 40 apartments in Helsinki (Figure 34). For the property-specific separate waste collection: 4 mixed waste bins emptied once a week, 1 cardboard bin emptied twice a week, 1 plastic package bin emptied once a week, 1 of each of glass and metal bins emptied once in 4 weeks, and 1 biowaste bin emptied once a week. Such composition and emptying frequency count about €3956 of costs for waste management for the company, with a share of mixed waste of €2637. In calculations, fees of HSY in 2021 are used. If you calculate instead of cardboard and plastic packaging fees mixed waste fees and add one more mixed waste bin instead of 3 others (metal, biowaste and glass), the total costs in this imagined case would be €5275 or €1318 more than in the real-life case.

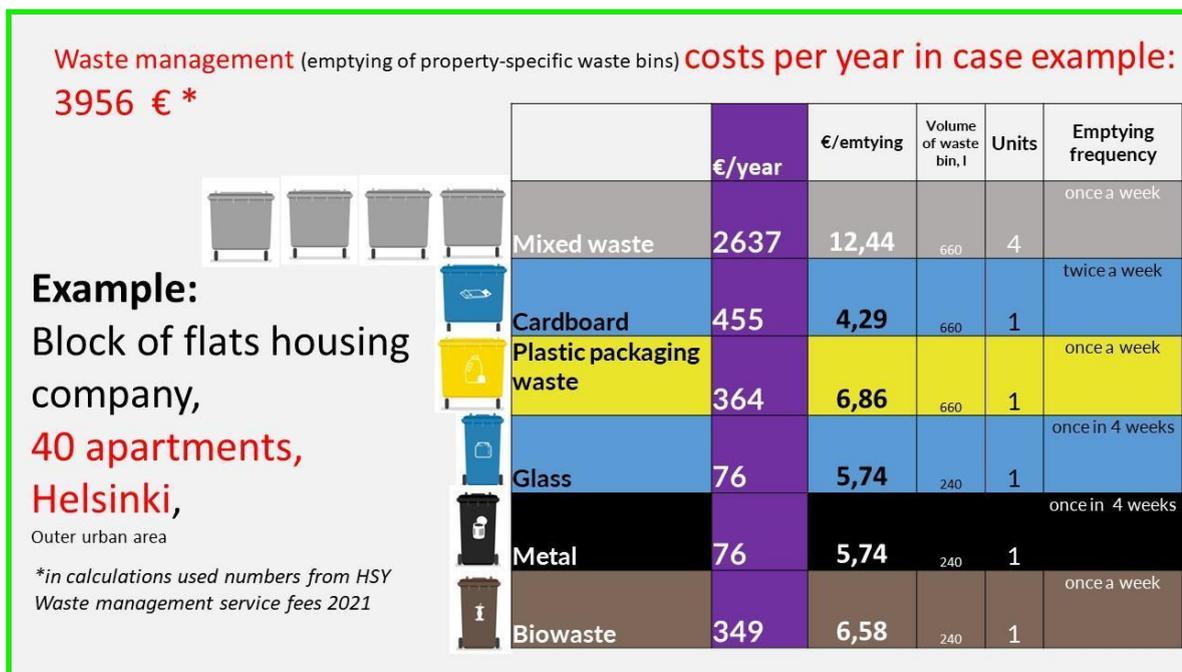


Figure 34. Example of annual waste emptying costs of a block of flats with 40 apartments.



Example "Housing company over 20 apartments", Vuosaari, Helsinki (24.9.2021)

Photo: Evilina Lutfi

9. Household waste or goods suitable for reuse from natural person/inhabitant perspective – imagination case from HSY - Helsinki Metropolitan area

Inhabitants can influence payments to MWMO, e.g. by optimizing emptying frequencies and volumes of waste bins. Example from HSY: mixed waste management of **660 l waste bin with emptying frequency once a week will cost a client in total €672** in 2021. And for example, for a detached property owner, mixed waste management of **300-360 l bin with emptying frequency once in two weeks will cost in total €267**. So, smaller bins and seldom emptying makes a difference. Then the following question: what to do with the waste, which does not fit in the smaller bin? The answer is sorting! Here are a few options available. If one is not able or would want to self-deliver to Sortti stations or RINKI eco take-back points, one can use the

sorting bins on the property instead of mixed waste bin, e.g. bin for plastic packaging waste or cardboard. Those are less expensive.

Self-delivering packaging waste to RINKI eco take-back points is easy for households. Such points are located close to (super)markets. The location could be found: <https://rinkiin.fi/en/for-households/rinki-eco-take-back-points/> (Figure 35).

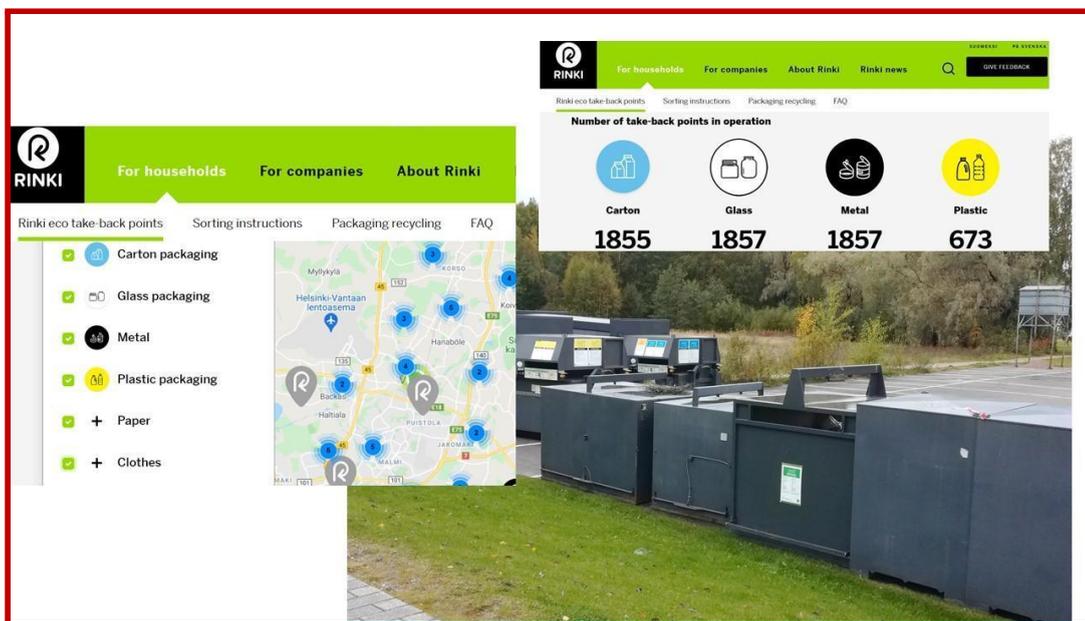


Figure 35. RINKI eco take-back points

Self-delivering, e.g. hazardous waste (e.g. used motor oil, paints, lamps) and electric & electronic equipment waste (WEEE), could be done **to HSY Sortti stations**. The WEEE (e.g. fridge, washing machine, TV) could also be delivered free of charge to shops that sell **such equipment**. **E.g. refurbishment waste** (plastic, wood, gypsum, insulation wool, mineral material) also could be **self-delivered by car to Sortti stations** (Figure 16). Pick-up service for old furniture could be ordered from HSY or self-delivered to Sortti station. Pharmaceutical waste could be delivered free of charge to pharmacies. For inhabitants of small holiday homes and around-the-year properties that are inaccessible by bin lorries, HSY **local mixed waste collection points** (in Kirkkonummi - Porkkala and Långvik) and Sortti stations are available. Small properties' use of such points and stations is subject to an annual fee.

HSY provides for inhabitants a lot of information and guides on sorting and separating waste collection (Figure 36).

Waste and recycling Water and sewers Air quality and climate HSY Environmental information Search

You are here: Jättilaet ja kierrätys > Jätteenpoisto > Waste category

Sorting problems? Waste guide helps
Find sorting instructions by waste item

Search waste

Paint, furniture Search

or

Browse by waste type

26 waste categories
In sorting option of waste-guide of HSY:
<https://www.hsy.fi/en/waste-and-recycling/waste-guide/waste-category/>

Biowaste	→	Car battery	→
Carton	→	End-of-life textiles	→
End-of-life vehicle	→	Glass	→
Gypsum waste	→	Large objects	→
Metal	→	Mixed waste	→
Mineral material	→	Non-combustible waste	→
Paper	→	Pharmaceutical waste (hazardous waste)	→
Plastic	→	Plastic packaging waste	→
Plastic packaging waste	→	Reusable items	→
Soil	→	Tyres	→
Wood waste	→	Waste electric and electronic equipment (WEEE)	→
Waste that requires special handling	→		

Figure 36. Collage of ScreenShots from HSY website.

Summarizing options for households to deal with their waste:

