FertiCovery

# Feedstock supply report

## Deliverable 5.1

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# Technical References

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1 PU = Public
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CO = Confidential, only for members of the consortium (including the Commission Services)

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## Abbreviations

| | |
|---|---|
| **BAT** | Best Available Technology |
| **BBF** | Bio-based fertiliser |
| **D** | Deliverable |
| **EBA** | European Biogas Association |
| **ECN** | European Compost Network |
| **EU** | European Union (from 2020) |
| **ha** | Hectare |
| **kt** | Thousand tonnes |
| **MS** | Member State |
| **MSW** | Municipal Solid Waste |
| **Mt** | Million tonnes |
| **N/A** | Not available |
| **NR** | Nutrient recovery |
| **T** | Task |
| **TBD** | To be determined |
| **yr** | Year |
| **WP** | Work package |

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## Summary

This report provides an overview of the availability of secondary raw materials for nutrient recovery technologies in the EU. Five main feedstock groups were evaluated: manure/digestate, bio-waste, sludges, industrial wastes and lignocellulosic biomass. Across all feedstock groups, significant quantities were generated each year across the EU.

Livestock **manure** is by far the largest generated feedstock by mass, with an estimated 1.1 to 1.9 billion tonnes per year produced in the EU. France, Germany and Spain together account for more than 40% of the total EU production. For France and Germany this is mostly cattle manure, whereas in Spain has the highest pig manure production in the EU. After accounting for organic farming practices and housing of livestock, the manure collection potential is estimated at 0.85 and 1.5 billion tonnes per year. Assuming that 10% of the collected manure is treated via anaerobic digestion, the production potential of **digestate from manure** is estimated between 81 and 142 million tonnes annually.

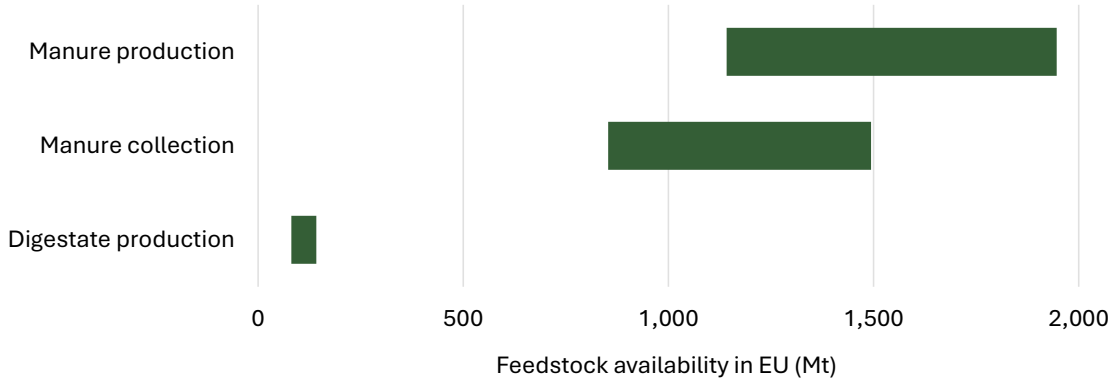



*Figure 1: Estimation of the availability of manure and digestate in 2024.*

**Bio-waste** generation in the EU is estimated between 78 and 112 million tonnes per year, of which only 43-47 million tonnes is separately collected, implying that about 31 to 69 million tonnes of bio-waste remain in the mixed municipal waste streams and are therefore underutilised. **Food waste** accounts for approximately 40 to 70 million tonnes per year, of which it is estimated that only 12 to 13 million tonnes is currently captured in the separate bio-waste collection. **Garden waste** makes up the other part of the bio-waste and accounts for about 28 to million tonnes generation per year.

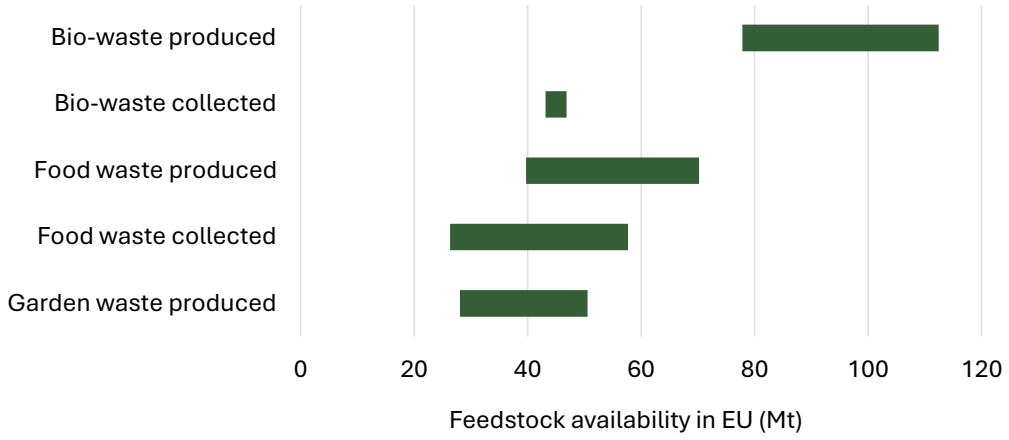



*Figure 2: Estimation of the availability of bio-waste, including food waste and garden waste in 2022.*

**Sewage sludge** production from urban wastewater treatment plants amounts to approximately 6.1 million tonnes of dry matter per year with significant differences in disposal pathway per MS. Other wastewater treatment plants produce 1.6 million tonnes of dry matter sludges per year in the countries that have reported this sludge production. 6.2 million tonnes dry matter industrial effluent sludges are produced annually in the EU.

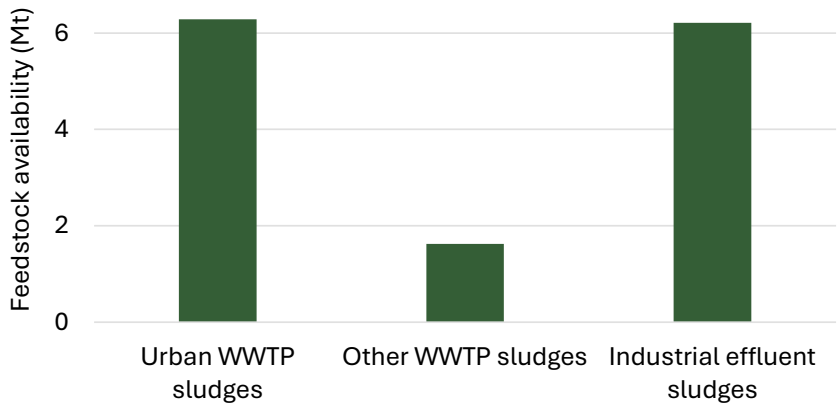



*Figure 3: Estimation of the availability of sludges in 2023.*

For **lignocellulosic biomass and other biomass** streams, the focus was on woody biomass (stemwood), forestry residues, agricultural residues such as straw, poultry feathers and potato processing residues. The total stemwood availability is estimated between 33 and 312 Mt. Forestry residue availability throughout the EU is estimated between 37 to 99 Mt. Straw (the non-cereal part), has an estimated availability of 58 to 166 Mt.




*Figure 4: Estimation of the availability of lignocellulosic biomass.*

Another stream that was estimated because of its use in a case study, were poultry feathers. The total estimated EU availability is between 0.1 and 0.7 Mt. Lastly, the availability of potato processing residues was estimated between 3 and 6 Mt.

Figure 5 provides an overview of the availability of the assessed feedstocks in this report, excluding manure due to the significant size of this feedstock group (see Figure 1).

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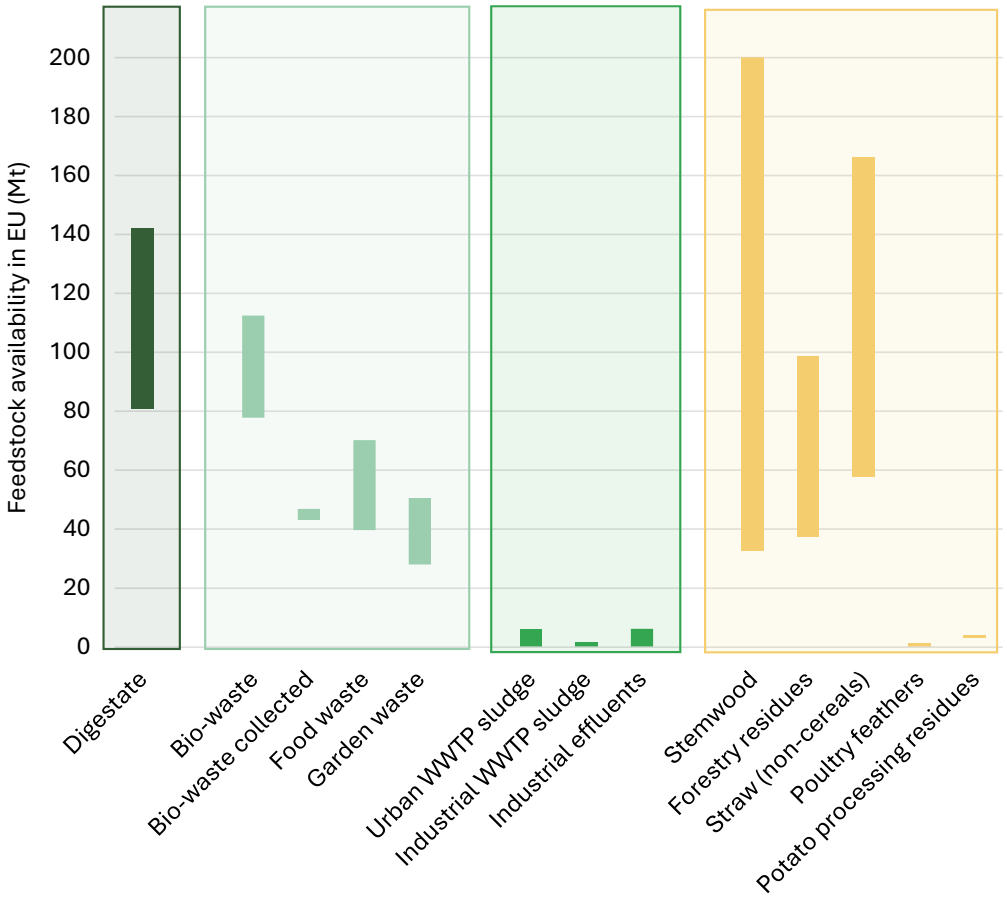



*Figure 5: Overview of the theoretical feedstock availabilities.*

Although an estimation of exact volumes has proven to be challenging, it can be concluded that most feedstocks that are relevant to produce bio-based fertilisers are abundant and available in each EU Member State. Current collection and application practices, however, differ and determine the possible recovery of bio-based fertilisers. Additionally, some residues are already valorised and the total availability as calculated in this report is therefore unlikely to fully be available for bio-based fertiliser production.

It is recommended to research and distinguish better between generation and actual availability, which is currently often lacking. Additionally, a more uniform use of definitions would make comparison studies more accurate. Tools and methods to assess availability of feedstocks at regional and local levels are recommended to further develop insights on these levels.

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# 1 Introduction

The FertiCovery project will select, analyse and describe the best available techniques to recover or recycle fertilising products from secondary raw materials. Within the analysis, the technical availability of secondary raw materials has to be assessed to understand which feedstocks can realistically support the further development and deployment of the technologies. This requires an assessment of total generation volumes, an evaluation of the collection, spatial distribution across the EU and site-level quantities.

## 1.1 Background

Throughout the EU, large quantities of waste streams are generated, amongst others livestock manure, digestate, bio-waste, and sewage sludge. These streams contain nutrients that can be recovered from the waste stream and recycled. These secondary raw materials can be used as feedstock for the production of bio-based fertilisers and soil improvers. However, their ability to produce a constant stream of fertiliser being able to replace the conventional fertiliser, partly depends on their availability and spatial distribution across the EU.

Multiple European datasets, statistical reports, reports from sector organisations and scientific literature exist on these secondary raw material streams. However, the information remains fragmented. Due to differences in definitions, reporting years, system boundaries (generation/collection), and assumptions/estimations, the direct comparison is complicated.

## 1.2 Objectives

The main objective of this deliverable is to assess the theoretical availability of the selected feedstocks across the EU. More specifically, the objectives are to:

- Quantify the theoretical generation and practically collectable amounts of the secondary raw material streams.
- Assess the geographical distribution of feedstocks at EU and Member State (MS) level.
- Estimate site-level availability, linking feedstock quantities to, amongst others, farm sizes and treatment plant capacities.
- Highlight uncertainties and assumptions that underly the reported data.

## 1.3 Scope

This report covers the five main feedstocks groups relevant for the FertiCovery case studies as selected in WP2, shown anonymised in Annex a):

1. Manure and digestate
2. Bio-waste
3. Sludges
4. Lignocellulosic and other biomass

The assessment focuses on the EU27 (from here on: EU), using the most recent data available. If harmonised statistics are unavailable, estimates and ranges are derived from literature values and expert assumptions.

## 1.4 Approach

This assessment of feedstocks follows a five-step approach:

1. Selection of relevant feedstocks based on FertiCovery technologies (see Annex a) and classification in common categories (chapters).

The case studies that were selected in Task 2.2 and described in Task 2.3 were analysed based on their feedstock requirements, see Annex a), Table 28. Subsequently, four feedstock groups were defined, as described in section 1.3. For the manure and digestate group: 2 technologies use manure, 2 technologies use digestate, and 3 technologies can use both manure and digestate. Bio-waste is reported as feedstock for 10 technologies. Sludges, including WWTP sludges and industrial effluent sludges, is a feedstock for 4 technologies. Lastly, lignocellulosic biomass is used for 2 technologies and other biomass is used in 2 technologies. It should be noted that some technologies can use several feedstocks, for the convenience of grouping them, the major feedstock that is used per technology has been reported in Annex a), Table 28, and in this section.

2. Collection and harmonisation of statistical data from Eurostat, EEA, ECN, EBA and literature.

Where available, statistical data from Eurostat was used as basis for reporting or further calculations. Additional data was obtained from, amongst others, European Environment Agency (EEA), the European Compost Network (ECN), and the European Biogas Association (EBA). Wherever possible, multiple sources were compared with each other and their assumptions were evaluated.

3. Estimation of data gaps with assumptions based on literature or expert opinions.

For feedstocks or Member States where data was unavailable or incomplete, data gaps were addressed using assumptions from literature, sector reports, and expert judgement. The assumptions were thoroughly checked by experts from the consortium.

4. Reporting of feedstock availability per MS and site availability.

Based on the data collected and estimated in steps 2 and 3, the feedstock availability was reported per feedstock group and, where possible, per Member State. Additionally, where relevant for some groups the availability per site level was estimated by linking feedstock quantities to farm/plant sizes.

5. Visualisation of results for a comparison across MS.

The results were visualised for comparison of the feedstock availability across Member States and feedstock types. Member States with the highest theoretical availability were pointed out and visualised to give a geographical comparison of the feedstocks throughout the EU.

## 1.5 This report

This report is structured according to the feedstock groups mentioned in section 1.3. Chapter 2 describes the feedstock availability of manure and digestate. Chapter 3 provides insight in the availability of bio-waste, including food waste and garden waste. In chapter 4, sludges including urban and other wastewater treatment plant sludges and industrial effluent sludges are assessed on their availability. Chapter 5 describes the estimated availability of lignocellulosic biomass (e.g., stemwood, agricultural residues) and other biomass (poultry feathers and potato processing residues). Chapter 6 discusses the conclusions and limitations of the study and the recommendations.

# 2 Group 1: Manure and Digestate

## 2.1 Manure

The total amount of manure produced depends on both the number of livestock and the average quantity of excretion per animal. Data on livestock numbers (here: pig, cattle and poultry) per MS were obtained from Eurostat and FAOSTAT.

For pigs, cattle and poultry, the number of animals per MS was retrieved from Eurostat, specifically from the data sets *agr_r_animal* (pig: *apro_mt_lspig*, *A3100* and bovine: *apro_mt_lscatl*, *A2000*) and *ef_lsk_main* for poultry (*A5000*) (Eurostat, 2025a; Eurostat, 2025b; Eurostat, 2025d). The poultry numbers were thus obtained from a different data set due to their unavailability in the *agr_r_animal*[1], therefore the numbers were cross-checked with FAOSTAT numbers, where Eurostat reported 1,591 million poultry, and FAOSTAT 1,434 million (FAOSTAT, 2025). Data from 2023 were used when available, when 2023 data was not available for a MS, the most recent available data were used instead.[2]

Manure excretion numbers per livestock type (e.g., kg/day/head) were estimated from EBA experts and Köninger et al. (2021). Köninger et al. (2021) describes the total manure production per livestock type for 2016-2019, via which the excretion factor per livestock was determined. The manure production values per livestock, as summarised in Table 1, were used to determine a range of manure production. Tampio et al. (2017) reports the volume of manure production per livestock type, with ranges that correspond with the values in Table 1.

*Table 1: Manure production per livestock type in tonnes/animal per year.*

| Livestock | Manure production (kg/animal/day) | Manure production (ton/head/year) |
|---|---|---|
| **Pig** | 3.3 – 10 | 1.2 – 3.6 |
| **Cattle** | 33.7 – 50 | 12.3 – 18.3 |
| **Poultry** | 0.17 – 0.26 | 0.06 – 0.10 |

It should be noted that "poultry" as reported in Eurostat *ef_lsk_main (A5000)* covers both egg production (layers) and meat production (broilers), as well as species other than chicken. Eurostat does disaggregate poultry in a separate dataset, *ef_lsk_poultry*, which distinguishes laying hens, broilers, ducks, geese, turkeys, guinea fowls and ostriches. Egg and meat production are distinct systems that have an influence on the manure production and collection. Laying hens are mostly housed in cages (45%) or barn systems (36%), and smaller amounts in free-ranging systems (13%) or organic production systems (7%) (Nielsen et al., 2023). Their manure is collected without bedding material, either continuously on belts running under the cages, by scraping or flushing, or from a deep pit. Broilers are raised in enclosed indoor facilities in short cycles of a few weeks. The material removed after each cycle is litter, namely a mixture of excreta, food waste, feathers, and bedding materials (Nielsen et al., 2023b).

The manure production and collection factors applied in this report do not differentiate between these systems. Neither Köninger et al. (2021) or the EBA experts report excretion separately for laying hens and broilers, and the farm size statistics for the site-level analysis in section 2.1.2 do not distinguish them either. The values applied here are averages across the poultry sector, and the range reported in Table 1 reflects the variation between sources. The poultry figures should thus be read as an aggregate order of magnitude for the sector as a whole.

[1] Eurostat *apro_ec_poula* reports the production/flows of chicks, not the actual stocks.
[2] Data from 2020 was used for the following MS: BE, DK, FI, IE, IT, LV and SI.

Combining these excretion rates with the livestock numbers yields the total estimated manure production per MS (Table 2). The number of livestock and the manure production per reference are shown in Annex b).

*Table 2: Estimated manure production in 2024 based on number of heads and manure production per livestock type.*

| Country | Pig manure production (Mt) | Cattle manure production (Mt) | Chicken manure production (Mt) |
|---|---|---|---|
| **AT** | 6 (3–9) | 28 (22–33) | 1 (1–2) |
| **BE** | 13 (6–20) | 33 (26–39) | 4 (3–5) |
| **BG** | 2 (1–3) | 9 (7–10) | 1 (1–2) |
| **CY** | 1 (0–1) | 1 (1–2) | 0 (0–0) |
| **CZ** | 3 (2–5) | 21 (17–26) | 2 (1–2) |
| **DE** | 52 (26–78) | 160 (129–191) | 13 (10–16) |
| **DK** | 28 (14–42) | 22 (17–26) | 2 (1–2) |
| **EE** | 1 (0–1) | 4 (3–4) | 0 (0–0) |
| **EL** | 2 (1–3) | 9 (7–11) | 2 (2–3) |
| **ES** | 84 (41–126) | 94 (76–113) | 18 (14–22) |
| **FI** | 2 (1–4) | 12 (9–14) | 1 (1–1) |
| **FR** | 28 (14–43) | 252 (203–301) | 22 (18–27) |
| **HR** | 2 (1–3) | 6 (5–8) | 1 (1–1) |
| **HU** | 7 (3–10) | 13 (11–16) | 3 (2–4) |
| **IE** | 4 (2–5) | 96 (78–115) | 1 (1–2) |
| **IT** | 19 (9–29) | 88 (71–105) | 14 (11–16) |
| **LT** | 1 (1–2) | 9 (7–11) | 1 (1–1) |
| **LU** | 0 (0–0) | 3 (2–3) | 0 (0–0) |
| **LV** | 1 (0–1) | 5 (4–6) | 0 (0–1) |
| **MT** | 0 (0–0) | 0 (0–0) | 0 (0–0) |
| **NL** | 25 (12–37) | 54 (44–65) | 7 (6–9) |
| **PL** | 22 (11–33) | 95 (76–113) | 18 (14–22) |
| **PT** | 5 (3–8) | 23 (18–27) | 4 (3–5) |
| **RO** | 8 (4–12) | 28 (22–33) | 4 (3–5) |
| **SE** | 3 (2–5) | 20 (16–24) | 2 (2–2) |
| **SI** | 1 (0–1) | 7 (6–8) | 1 (0–1) |
| **SK** | 1 (0–2) | 6 (5–8) | 1 (1–1) |
| **EU** | **321 (159–483)** | **1,099 (884–1,313)** | **125 (99–151)** |

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**Pig manure** results, as shown in Figure 6, indicate that over 25% of the total pig manure produced in the EU originates from Spain, followed by Germany representing about 16%. France, Denmark, the Netherlands and Poland contribute approximately 7 to 10%.

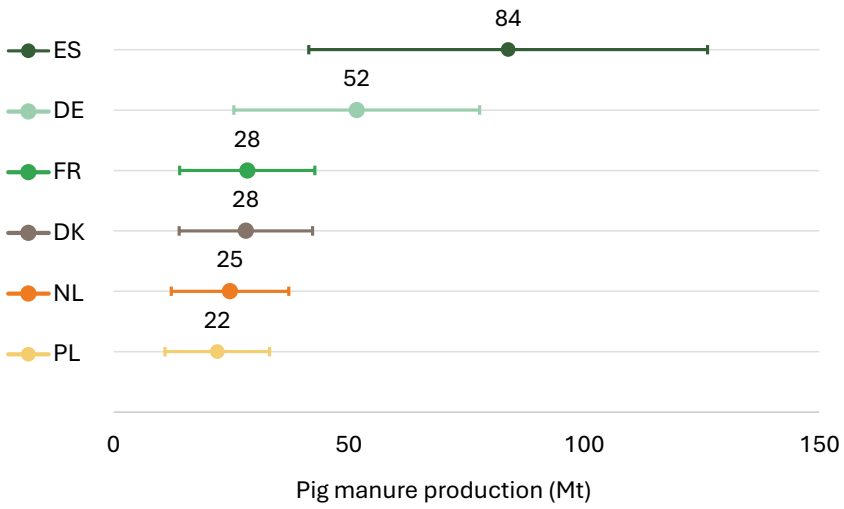



*Figure 6: Estimated pig manure production in 2024.*

**Cattle manure** results, see Figure 7, show that over 20% of the total cattle manure produced in the EU originates from France, whereas cattle manure from Germany represents about 15%. Ireland, Poland, Spain and Italy contribute approximately 8 to 9%.

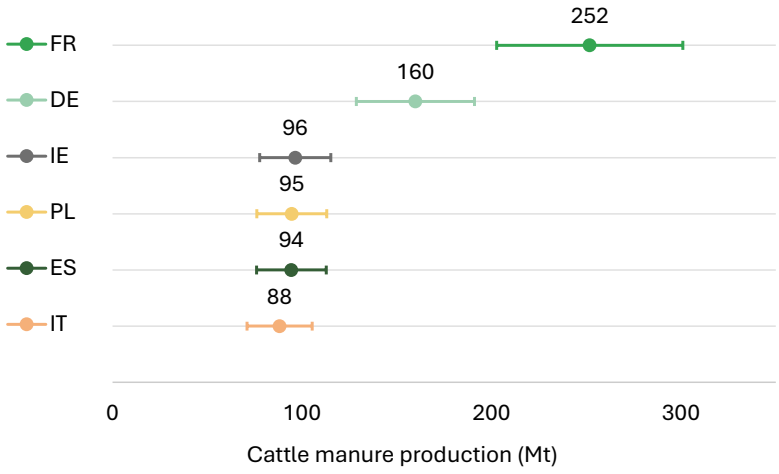



*Figure 7: Estimated cattle manure production in 2024.*

**Poultry manure** results, as shown in Figure 8, indicate that France makes up for more than 17% of the production, followed by Spain and Portugal making up 14%. Italy, Germany and the Netherlands follow with slightly smaller shares.

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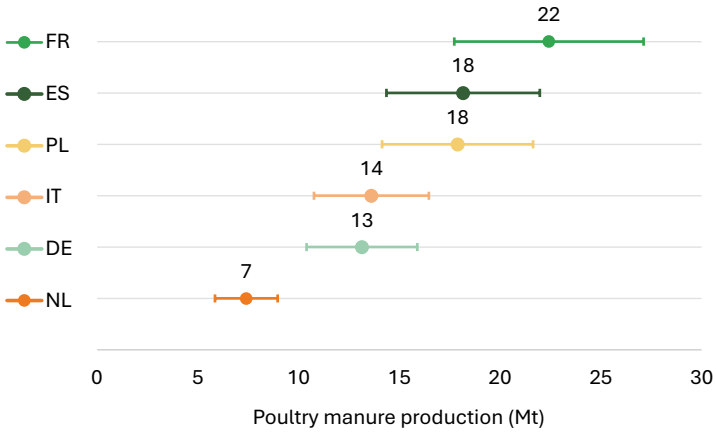



*Figure 8: Estimated poultry manure production in 2024.*

Adding the manure production of these three livestock types gives an annual **total estimated livestock manure production for EU between 1.1 and 1.9 billion ton**. Figure 9 shows the estimated manure production for the EU in 2024, whereas Figure 10 shows the estimated manure production from pig, cattle and poultry for 2024 for the eight most producing MS.

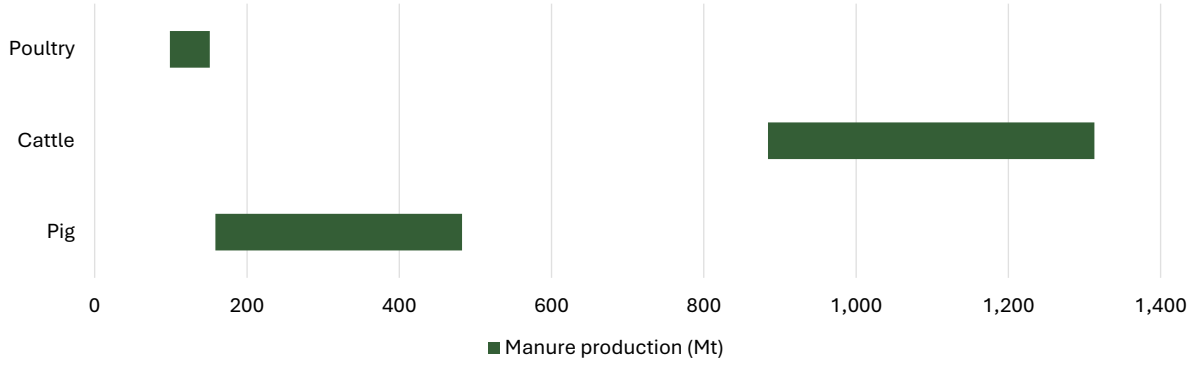



*Figure 9: Manure production for pig, cattle and poultry in 2024 in Mt.*

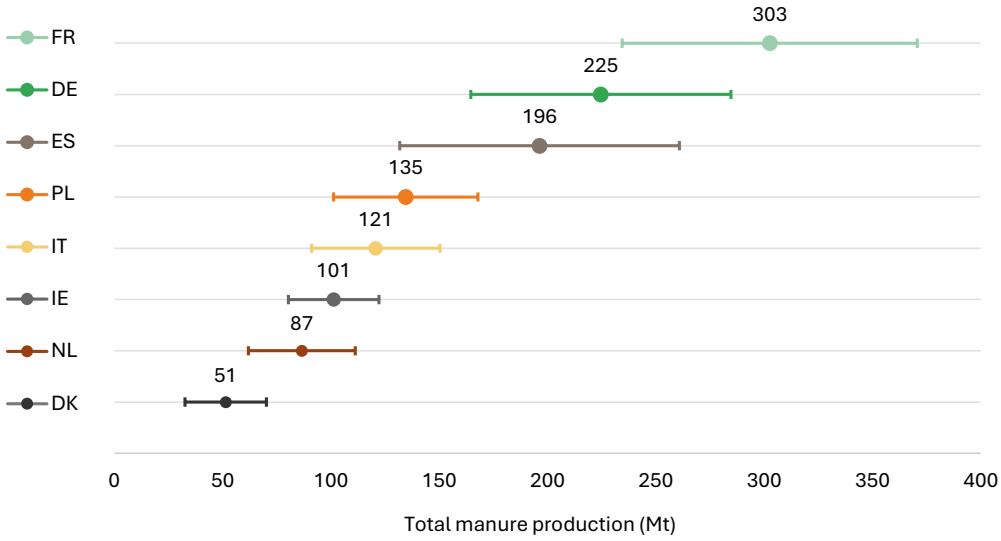



*Figure 10: Estimated manure production from pig, cattle and poultry in 2024 for the top 8 producing MS.*

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### 2.1.1 Actual availability

The figures presented above describe the **theoretical availability** of manure based on the total production. However, the amount of manure that is **actually collected** is strongly influenced by manure management systems and farm type, in particular the extent of which livestock is housed indoors or kept outdoors (e.g., grazing or access to outdoor areas).

To estimate the actual manure availability, it is assumed that **organic farming systems generally have longer outdoor periods or larger outdoor areas for livestock,** resulting in a higher share of manure being deposited directly on soil rather than collected in housing systems. This assumption is applied to all three livestock categories considered in this study. In addition, even in conventional (meaning: non-organic) cattle farming systems, animals are typically housed indoors only part of the year, which further reduces manure collection compared to pigs and poultry.

The share of livestock raised under organic farming ($\text{livestock}_{\text{org}}$) is obtained from the Eurostat database *org_lstspec* (Eurostat, 2025c). Collection factors for conventional livestock systems are derived from EEA (2023), which reports typical indoor housing periods of approximately 180 days for cattle and 365 days for pigs and poultry. For pigs and poultry, a loss of 10% is assumed to account for manure deposited outside the housing systems, resulting in a conventional collection factor of 0.9.

For organic livestock systems, lower collection factors are applied based on EU organic farming regulations. As stated in EU regulation 2020/464 (article 12), all organic porcine animals (pigs) should have an outdoor area (European Parliament and Council, 2020). As a result, a significantly lower organic collection factor of 0.5 is assumed for pigs. For poultry, EU regulation 2018/848, requires access to open-air areas for at least one third of the animals' lifetime (European Parliament and Council, 2018a). However, evidence suggests that not all poultry in large groups tend to go outside (Soil Association, n.a.). Therefore, the organic collection factor is assumed to be only slightly lower than the conventional collection factor.

For cattle, EU regulation 2018/848 states that animals shall have access to pasturage whenever conditions allow (European Parliament and Council, 2018a). Assuming an average grazing period between April and November, organic cattle are estimated to spend approximately 210 days outdoors, compared to 150-180 days for conventionally kept cattle (EEA, 2023). Based on this, the organic collection factor for cattle is set to 0.5.

The manure collection potential is calculated by combining the share of organic and conventional livestock with their respective collection factors. The following equations are applied:

$$\text{Organic collection}_{\text{potential}} = \text{livestock}_{\text{org}} \times \text{collection}_{\text{org}}$$

$$\text{Conventional collection}_{\text{potential}} = \left(1 - \text{livestock}_{\text{org}}\right) \times \text{collection}_{\text{conventional}}$$

$$\text{Manure}_{\text{collected}} = \text{Manure}_{\text{produced}} \times \text{collection}_{\text{potential}}$$

Table 3 shows the organic livestock percentages, the applied collection factors and the resulting manure collection potential at EU level.

*Table 3: Organic livestock numbers (2023 data for pig and cattle; 2020 for poultry) (Eurostat, 2025c) and estimated collection factors and potential for conventional and organic farms for EU.*

| | Organic livestock (% of all livestock) | Conventional collection factor (-) | Organic collection factor (-) |
|---|---|---|---|
| **Pig** | 1.0% | 0.9 | 0.5 |
| **Cattle** | 9.4% | 0.7 | 0.5 |
| **Poultry** | 3.9% | 0.9 | 0.7 |

These calculations result in an **estimated EU manure collection potential between 853 and 1,494 Mt**, see Table 4, Figure 11 and Figure 12. Annex b), Table 30, Table 31, and Table 32 report respectively the organic, conventional and total manure collection potential per MS.

*Table 4: Summary of the estimated manure collection potential in EU.*

| | Organic farm manure collection potential (Mt) | | Conventional farm manure collection potential total (Mt) | | Manure collection potential total (Mt) | |
|---|---|---|---|---|---|---|
| | Midpoint | Range | Midpoint | Range | Midpoint | Range |
| **Pig** | 1 | 1 – 2 | 287 | 142 – 433 | **289** | **143 – 435** |
| **Cattle** | 39 | 32 – 47 | 734 | 591 – 877 | **773** | **622 – 924** |
| **Poultry** | 3 | 3 – 4 | 108 | 86 – 131 | **112** | **88 – 135** |
| **Total** | **44** | **35 – 53** | **1,130** | **818 – 1,441** | **1,174** | **853 – 1,494** |

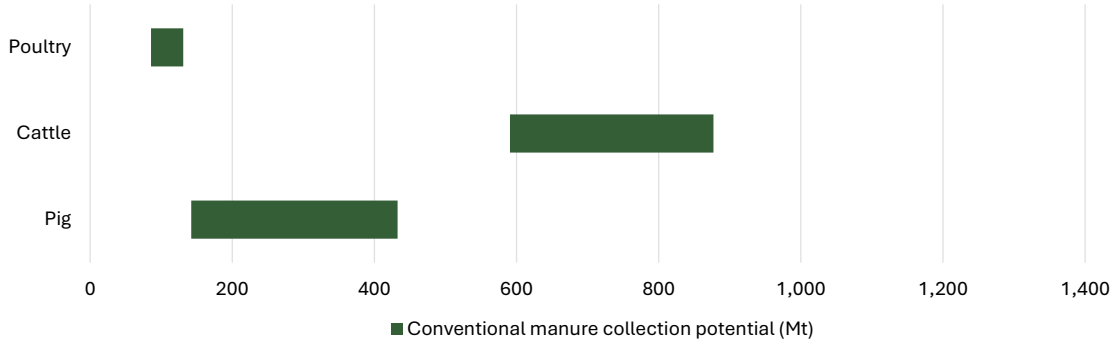



*Figure 11: Estimated manure collection potentials from conventional livestock farm type for the EU.*

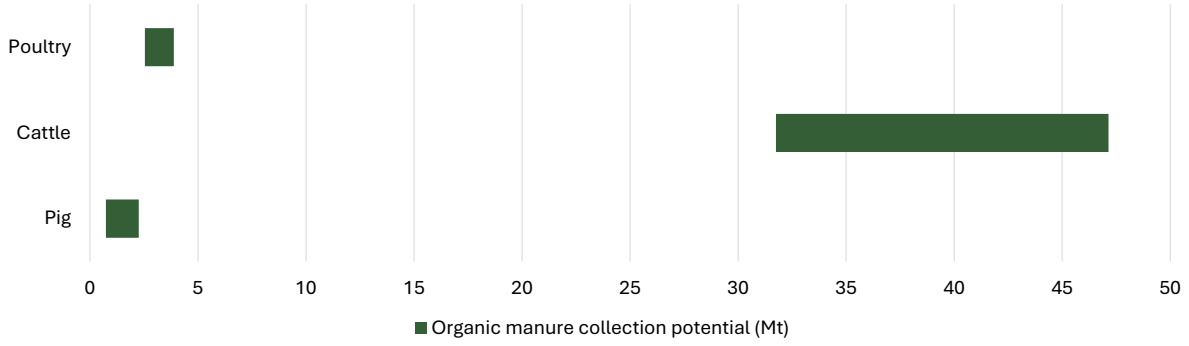



*Figure 12: Estimated manure collection potentials from organic livestock farm type for the EU.*

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### 2.1.2 Theoretical availability at site level

Eurostat *ef_lsk_main* reports the heads and holdings per range of agricultural land size (based on hectares) (Eurostat, 2025d). It should be noted that the total number of livestock from this database does not match exactly with the numbers from the *agr_r_animal*, used in the previous sub-section. This can be explained by the fact that the data was collected from different surveys because it serves different purposes. Where the focus of *ef_lsk_main* is to describe the farm structure, *agr_r_animal* monitors national livestock numbers for production. *agr_r_animal* is also an annual livestock count, whereas *ef_lsk_main* is once every few years. Therefore, it is decided to follow *agr_r_animal* for the number of animals as described in the previous section and use *ef_lsk_main* for an estimation of the manure per farm at different site levels. Note that *ef_lsk_main* reports poultry data, whereas for the previous section, chicken data from FAOSTAT has been used.

The full data for the animals and holdings per site level per MS in 2023 can be seen in Annex b). Table 5 summarises that Annex for the EU totals. From this table, and Figure 13, it can be seen that there are mostly smaller (0-29 ha) farms and less bigger (>30 ha) farms. Typically, small size farms are utilised for pigs and poultry.

*Table 5: Number of livestock (animals in thousands) and holdings (farms in thousands) per site level in EU.*

| | 0-5 ha | | 5-29 ha | | 30-99 ha | | >100 ha | |
|---|---|---|---|---|---|---|---|---|
| | Animals | Farms | Animals | Farms | Animals | Farms | Animals | Farms |
| **Pig** | 6,747 | 339 | 16,430 | 192 | 24,019 | 53 | 26,185 | 21 |
| **Cattle** | 1,722 | 228 | 9,001 | 418 | 17,213 | 213 | 27,193 | 128 |
| **Poultry** | 151,718 | 723 | 219,982 | 401 | 217,419 | 67 | 230,942 | 18 |

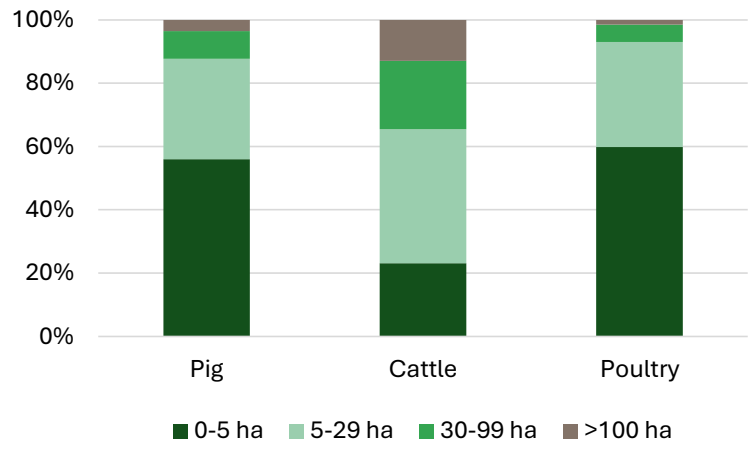



*Figure 13: Distribution of farm sizes per livestock.*

By knowing the number of heads for each farm size and the number of holdings in that size range, an average amount of animals per holding in each category can be calculated. Based on the manure production per livestock from Table 1, the tonnes of manure per holding per year can be calculated. Table 6 summarises this for an EU average.

*Table 6: Calculated tonnes of manure per holding per year for each farm size (based on data from Eurostat 2025d).*

| | 0-5 ha | | 5-29 ha | | 30-99 ha | | >100 ha | |
|---|---|---|---|---|---|---|---|---|
| | Midpoint | Range | Midpoint | Range | Midpoint | Range | Midpoint | Range |
| **Pig** | 1096 | 542-1,650 | 890 | 440-1,340 | 1,219 | 603-1,835 | 3,008 | 1,488-4,528 |
| **Cattle** | 427 | 343-510 | 542 | 436-648 | 1,228 | 989-1,468 | 3,650 | 2,938-4,362 |
| **Poultry** | 346 | 274-419 | 327 | 259-396 | 422 | 333-510 | 1,132 | 895-1,369 |

## 2.2 Digestate from manure

Anaerobic digestion (AD) of livestock manure reduces methane emissions compared with the direct application of manure on soil, produces biogas and digestate, containing the nutrients. AD can be done with various feedstocks, for example: food waste, bio-waste, manure, and sewage sludge. According to EBA, the total combined biogas and biomethane production amounted to 22 billion cubic meters (bcm) in 2024 with national production volumes reported in the latest EBA statistical report (EBA, 2024).

Nevertheless, the exact volumes of solely manure currently being used in AD, as well as the quantity of digestate are difficult to assess, because available statistics and official national data in several countries on biogas production do not distinguish between agricultural residues and manure. Therefore, the results can be calculated using best estimates and geographical data.

A mass balance approach is used to determine a rough estimate of the digestate from manure. Based on the livestock numbers and the excretion factors, a total of 1,142 and 1,947 Mt of manure was calculated in section 2.1, of which between 853 and 1,494 Mt can, in theory, be collected (section 2.1.1).

BTG assumes that 10% of the collected manure (see section and Table 3 for calculation) is treated by anaerobic digestion (85-149 Mt), also based on the assumption of Köninger et al. (2021), who reported that more than 90% of the generated manure is directly re-applied on soils as fertiliser. Following IEA (2021), the type of livestock has a significant impact on the biogas yield and a methane potential, shown in Table 7. Using a biogas density of 1.21 kg/m$^3$, the biogas yield in kg per animal can be calculated.

*Table 7: Biogas yield per livestock (source: IEA, 2021).*

| | Biogas yield ($m^3$ / animal * $yr^{-1}$) |
|---|---|
| **Pig/swine** | 35 |
| **Dairy cattle** | 527 |
| **Poultry** | 3.5 |

Via mass balance approach and assuming that only manure enters the AD and only biogas and digestate are produced, the total produced digestate per livestock type and per MS can be calculated, as visible in Table 8. This calculation results in a total amount of digestate from manure between 81 and 142 Mt, which is in line with estimations by EBA experts, that report a **total amount of digestate from manure between 96.2 and 135 Mt** (see Table 8).

While EU-level estimates of biogas and digestate from manure are consistent with values reported by EBA experts, the distribution of digestate across MS has to be interpreted with caution. The applied approach assumes that a uniform share (10%) of the collected manure is treated by anaerobic digestion in each MS. This simplification does not reflect the strong differences in anaerobic digestion infrastructure and feedstock use across countries. In several MS, such as Austria and Belgium, manure currently contributes only a small share of the feedstock for the biogas production, whereas this calculation implicitly results in a higher share. Thus, **MS level results should be interpreted as indicative potential values rather than**

**a representation of current practice.** This uniform share is also applied across livestock types. In practice however, poultry manure is rarely mono-digested, due to its high dry matter content, low carbon to nitrogen ratio, the non-digestible bedding fraction of the broiler litter and the ammonia build-up during digestion, which can eventually stop the AD process and methane production (Ngo et al, 2022; Nutri2Cycle, 2019). The digestate potential attributed to poultry in this section, corresponding to approximately 10% of the total, should therefore be regarded as an upper bound.

EBA experts have provided their data of the total digestate from manure per MS, as shown in the last column in Table 8.

*Table 8: Estimated production potential of digestate from manure (Mt) in EU27 in 2024 (digestate per livestock estimated, and total digestate from EBA experts).*

| Country | Pig digestate (Mt) | | Cattle digestate (Mt) | | Poultry digestate (Mt) | | Total digestate (Mt) |
|---|---|---|---|---|---|---|---|
| | Midpoint | Range | Midpoint | Range | Midpoint | Range | Range |
| **AT** | 0.5 | 0.3 - 0.8 | 1.8 | 1.4 - 2.1 | 0.1 | 0.1 - 0.1 | **0.4 - 3.6** |
| **BE** | 1.1 | 0.6 - 1.7 | 2.3 | 1.8 - 2.7 | 0.3 | 0.2 - 0.4 | **0.4 - 4.6** |
| **BG** | 0.2 | 0.1 - 0.2 | 0.6 | 0.5 - 0.7 | 0.1 | 0.1 - 0.1 | **N/A** |
| **CY** | 0.1 | 0.0 - 0.1 | 0.1 | 0.1 - 0.1 | 0.0 | 0.0 - 0.0 | **N/A** |
| **CZ** | 0.3 | 0.1 - 0.4 | 1.3 | 1.1 - 1.6 | 0.1 | 0.1 - 0.2 | **2.7 - 21** |
| **DE** | 4.5 | 2.2 - 6.8 | 10.9 | 8.8 - 13.0 | 0.9 | 0.7 - 1.1 | **22 - 57** |
| **DK** | 2.4 | 1.2 - 3.6 | 1.4 | 1.1 - 1.7 | 0.1 | 0.1 - 0.1 | **3.7 - 12** |
| **EE** | 0.1 | 0.0 - 0.1 | 0.2 | 0.2 - 0.3 | 0.0 | 0.0 - 0.0 | **0.2 - 0.4** |
| **EL** | 0.2 | 0.1 - 0.2 | 0.7 | 0.5 - 0.8 | 0.2 | 0.1 - 0.2 | **0.9 - 1.2** |
| **ES** | 7.2 | 3.6 - 10.8 | 6.4 | 5.1 - 7.6 | 1.3 | 1.0 - 1.6 | **1 - 15** |
| **FI** | 0.2 | 0.1 - 0.3 | 0.8 | 0.6 - 1.0 | 0.1 | 0.1 - 0.1 | **0.1 - 0.2** |
| **FR** | 2.5 | 1.2 - 3.7 | 16.9 | 13.6 - 20.2 | 1.6 | 1.2 - 1.9 | **2.6 - 19** |
| **HR** | 0.2 | 0.1 - 0.3 | 0.4 | 0.3 - 0.5 | 0.1 | 0.0 - 0.1 | **N/A** |
| **HU** | 0.6 | 0.3 - 0.8 | 0.9 | 0.7 - 1.1 | 0.2 | 0.2 - 0.3 | **0.9 - 1** |
| **IE** | 0.3 | 0.1 - 0.5 | 6.7 | 5.4 - 8.0 | 0.1 | 0.1 - 0.1 | **N/A** |
| **IT** | 1.9 | 1.0 - 2.9 | 6.0 | 4.9 - 7.2 | 1.0 | 0.8 - 1.2 | **13 - 21** |
| **LT** | 0.1 | 0.1 - 0.2 | 0.6 | 0.5 - 0.7 | 0.1 | 0.0 - 0.1 | **0.06 - 0.3** |
| **LU** | 0.0 | 0.0 - 0.0 | 0.2 | 0.2 - 0.2 | 0.0 | 0.0 - 0.0 | **0.6 - 1** |
| **LV** | 0.1 | 0.0 - 0.1 | 0.4 | 0.3 - 0.4 | 0.0 | 0.0 - 0.0 | **0.06 - 0.3** |
| **MT** | 0.0 | 0.0 - 0.0 | 0.0 | 0.0 - 0.0 | 0.0 | 0.0 - 0.0 | **N/A** |
| **NL** | 2.2 | 1.1 - 3.3 | 3.8 | 3.1 - 4.6 | 0.5 | 0.4 - 0.6 | **1 - 6.2** |
| **PL** | 2.1 | 1.0 - 3.1 | 6.4 | 5.2 - 7.7 | 1.3 | 1.0 - 1.5 | **1 - 8** |
| **PT** | 0.5 | 0.2 - 0.7 | 1.5 | 1.2 - 1.8 | 0.3 | 0.2 - 0.3 | **0.001 - 12** |
| **RO** | 0.7 | 0.3 - 1.0 | 1.9 | 1.5 - 2.2 | 0.3 | 0.2 - 0.3 | **0.06 - 2.4** |
| **SE** | 0.3 | 0.1 - 0.4 | 1.3 | 1.1 - 1.6 | 0.1 | 0.1 - 0.2 | **1.4 - 2.3** |
| **SI** | 0.0 | 0.0 - 0.1 | 0.5 | 0.4 - 0.5 | 0.0 | 0.0 - 0.0 | **0.01 - 2.5** |
| **SK** | 0.1 | 0.0 - 0.1 | 0.4 | 0.3 - 0.5 | 0.1 | 0.0 - 0.1 | **0.1 - 0.8** |
| **EU** | **28.1** | **13.9 - 42.3** | **74.4** | **59.9 - 88.9** | **8.8** | **7.0 - 10.6** | **96.2 - 135** |

The countries with the highest total digestate production potential are shown in Figure 14.

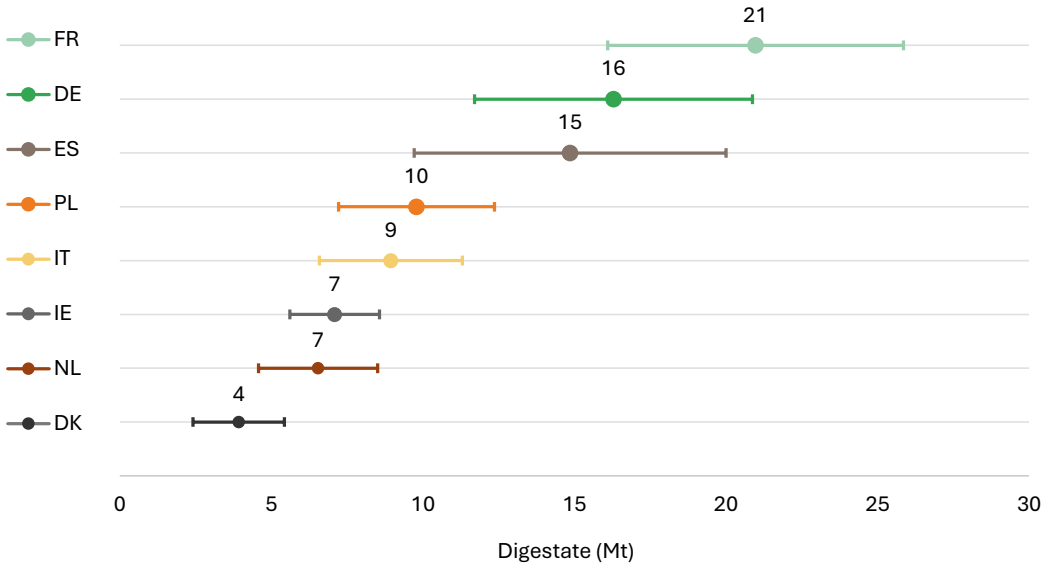



*Figure 14: Estimated production potential of digestate from manure in 2024, highest potential countries.*

### 2.2.1 Availability at site level

Assuming that all collected manure (section 2.1.1) at the farm sizes from Table 6 can be digested, gives a theoretical potential of digestate per holding per year, as shown in Table 9. In reality, there is a minimum size of digestion facilities which is not feasible for small farms. Therefore, it is common to have an initiative where multiple farms collect and treat their manure in one place instead of individually.

*Table 9: Calculated tonnes of digestate per holding per year for each farm size.*

| | 0-5 ha | | 5-29 ha | | 30-99 ha | | >100 ha | |
|---|---|---|---|---|---|---|---|---|
| | Midpoint | Range | Midpoint | Range | Midpoint | Range | Midpoint | Range |
| **Pig** | 793 | 383 - 1,203 | 644 | 311 - 977 | 882 | 427 - 1,338 | 2,177 | 1,053 - 3,301 |
| **Cattle** | 307 | 243 - 372 | 390 | 308 - 472 | 885 | 700 - 1,070 | 2,629 | 2,078 - 3,180 |
| **Poultry** | 250 | 194 - 305 | 236 | 183 - 289 | 304 | 236 - 372 | 816 | 633 - 998 |

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## 2.3 Solid and liquid fraction digestate

EBA reported that approximately 50% of digestate produced in Europe comes from agricultural feedstock, of which the bulk (62%) is manure based, thus 135 Mt in the EU. Typically, the liquid fraction of whole digestate represents approximately 94%. This percentage has been applied to the total digestate quantities per MS, as shown in Table 10.

*Table 10: Digestate solid and liquid fraction per MS, based on digestate calculations and EBA data.*

| Country | Total digestate (Mt) | Solid fraction digestate (Mt) | Liquid fraction digestate (Mt) |
|---|---|---|---|
| **AT** | 0.4 - 3.6 | 0.1 - 0.2 | 1.7 - 2.8 |
| **BE** | 0.4 - 4.6 | 0.2 - 0.3 | 2.5 - 4.5 |
| **BG** | N/A | N/A | N/A |
| **CY** | N/A | N/A | N/A |
| **CZ** | 2.7 - 21 | 0.1 - 0.1 | 1.2 - 2.0 |
| **DE** | 22 - 57 | 0.7 - 1.3 | 11.0 - 19.6 |
| **DK** | 3.7 - 12 | 0.2 - 0.3 | 2.3 - 5.1 |
| **EE** | 0.2 - 0.4 | 0.0 - 0.0 | 0.2 - 0.4 |
| **EL** | 0.9 - 1.2 | 0.0 - 0.1 | 0.7 - 1.2 |
| **ES** | 1 - 15 | 0.6 - 1.2 | 9.1 - 18.8 |
| **FI** | 0.1 - 0.2 | 0.1 - 0.1 | 0.8 - 1.3 |
| **FR** | 2.6 - 19 | 1.0 - 1.6 | 15.1 - 24.2 |
| **HR** | N/A | N/A | N/A |
| **HU** | 0.9 - 1 | 0.1 - 0.1 | 1.1 - 2.0 |
| **IE** | N/A | 0.4 - 0.5 | 5.3 - 8.0 |
| **IT** | 13 - 21 | 0.4 - 0.7 | 6.2 - 10.6 |
| **LT** | 0.06 - 0.3 | 0.0 - 0.1 | 0.6 - 0.9 |
| **LU** | 0.6 - 1 | 0.0 - 0.0 | 0.1 - 0.2 |
| **LV** | 0.06 - 0.3 | 0.0 - 0.0 | 0.3 - 0.5 |
| **MT** | N/A | N/A | N/A |
| **NL** | 1 - 6.2 | 0.3 - 0.5 | 4.3 - 8.0 |
| **PL** | 1 - 8 | 0.5 - 0.8 | 6.8 - 11.6 |
| **PT** | 0.001 - 12 | 0.1 - 0.2 | 1.6 - 2.7 |
| **RO** | 0.06 - 2.4 | 0.1 - 0.2 | 1.9 - 3.4 |
| **SE** | 1.4 - 2.3 | 0.1 - 0.1 | 1.2 - 2.0 |
| **SI** | 0.01 - 2.5 | 0.0 - 0.0 | 0.4 - 0.6 |
| **SK** | 0.1 - 0.8 | 0.0 - 0.0 | 0.4 - 0.7 |
| **EU** | **96.2 - 135** | **5.0 - 8.9** | **75.7 - 133.1** |

Based on this chapter about manure and digestate availability, the midpoints of the value ranges can be shown in a Sankey diagram, as shown in Figure 15. The manure not collected is left on the land directly after the animal excretion. The “other purposes” after collection can still mean spreading the manure on the land.

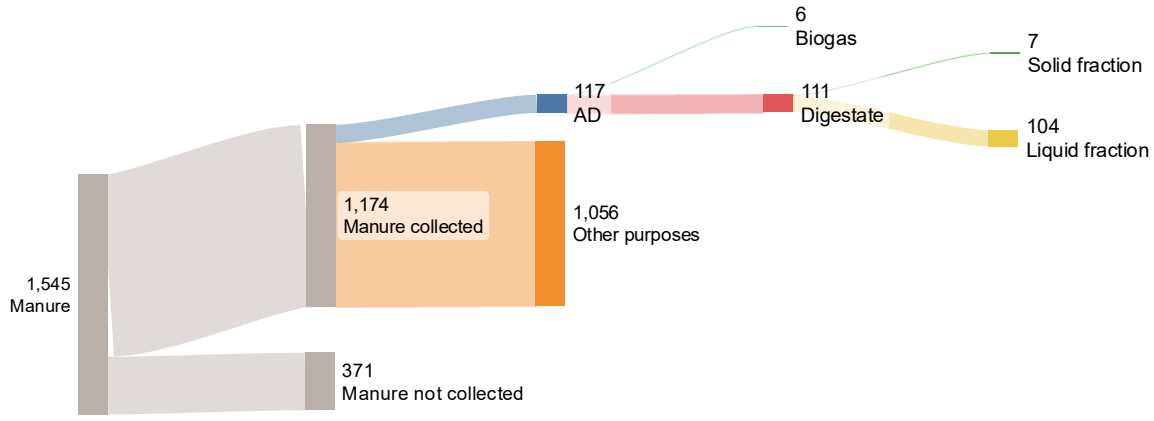



*Figure 15: Sankey diagram of the manure processing towards digestate (in Mt).*

# 3 Group 2: Bio-waste

According to the Waste Framework Directive (Article 3): "'bio-waste' means biodegradable garden and park waste, food and kitchen waste from households, offices, restaurants, wholesale, canteens, caterers and retail premises and comparable waste from food processing plants" (European Parliament and Council, 2008).

Food waste in turn is defined by the supplement to Directive 2008/98/EC, relying on the definition of all food as defined in Article 2 of Regulation (EC) No 178/2002 as "any substance or product, whether processed, partially processed or unprocessed, intended to be, or reasonably expected to be ingested by humans." (European Parliament and Council, 2002). Therefore, food waste includes these items if they are waste. Eurostat's *env_wasfw* database uses this definition of food waste.

Garden waste is not legally defined at EU level, it generally means garden and park waste (as stated in the bio-waste definition), or landscape maintenance waste.

In this chapter, several references are used which all use different definitions, make their own assumptions, and extract data from different sources. Therefore, to assess these references, the key assumptions per reference are stated below.

**Bio-based Industries Consortium in collaboration with Zero Waste Europe, Bio-waste generation in the EU (BIC, 2024):**

- BIC (2024) reports 2022 data on food and bio-waste generation and collection, which is mostly collected from Eurostat, public reports and national statistics.
- Bio-waste generation estimates use Eurostat data combined with climate/housing conditions based on a 2014 study (Bräutigam et al., 2014), and adjusted with national statistics if available.
- The impurities in separately collected bio-waste are not considered and are counted as bio-waste.
- The share of food waste within the collected bio-waste stream relied on assumptions for % of food waste in the collected bio-waste based on three types of countries: commingled schemes (20% bio-waste is food waste), no food waste collection (0%), or if national data is available then that is reported.
- There is a lack of harmonised data on food waste remaining in the residual waste stream

**ECN, data report 2022 (ECN, 2022):**

- Reports 2019-2020 data on separately collected bio-waste, sourced from national compost and digestion associations. EEA (2020) data was used to supplement ECN survey data if gaps existed. If both EEA and ECN data was absent, country data were estimated using 25 percentile of the calculated amount of bio-waste collected per capita.
- ECN reports bio-waste entering treatment facilities, which reflects the existing composting and digestion infrastructure, not the total bio-waste generation.

**European Environment Agency, Bio-waste in Europe (EEA, 2020):**

- Reports data from 2017, sourced from Eurostat and the European Reference Model on Municipal Waste (ETC/WMGE from Eionet). This model uses estimations to fill in gaps related to the generated and collected bio-waste, and the data for food and garden waste.
- The model estimations are based on literature, waste composition studies, national reporting, and Eionet member input.
- Food waste is estimated based on composition estimates in municipal mixed waste.

## 3.1 Bio-waste

### 3.1.1 Generated bio-waste

The report of Bio-based Industries Consortium in collaboration with Zero Waste Europe (BIC, 2024) reports the total bio-waste generated and collected per MS for 2022 for households, commercial and industrial sources. Additionally, ECN (2022) states the assumption that in general, MSW consists of 34 to 46% of bio-waste. Taking Eurostat *env_wasmun* (2025f) values for the MSW generation, a range of bio-waste values can be calculated[3]. Taking these sources into account, results in the values in Table 11.

*Table 11: Generated bio-waste in 2022 (sources: BIC, 2024; Eurostat, 2025f; ECN, 2022).*

| Country | Bio-waste generated in 2022 (Mt) | | Bio-waste generated in 2022 (kg/cap) | |
|---|---|---|---|---|
| | Midpoint | Range | Midpoint | Range |
| AT | 2.8 | 2.3-3.3 | 313 | 257-369 |
| BE | 3.2 | 2.7-3.7 | 276 | 235-317 |
| BG | 1.3 | 1.1-1.5 | 195 | 166-224 |
| CY | 0.2 | 0.1-0.3 | 209 | 118-301 |
| CZ | 2.3 | 2.0-2.7 | 220 | 187-253 |
| DE | 20.2 | 17.2-23.3 | 243 | 207-280 |
| DK | 1.8 | 1.5-2.1 | 304 | 258-349 |
| EE | 0.2 | 0.2-0.3 | 170 | 127-213 |
| EL | 2.2 | 1.8-2.5 | 208 | 176-239 |
| ES | 9.2 | 7.8-10.6 | 193 | 164-222 |
| FI | 1.2 | 1.0-1.3 | 209 | 177-240 |
| FR | 14.6 | 12.4-16.8 | 214 | 182-246 |
| HR | 0.7 | 0.6-0.9 | 194 | 163-225 |
| HU | 1.8 | 1.3-2.4 | 191 | 138-244 |
| IE | 1.2 | 1.2-1.2 | 255 | 217-293 |
| IT | 11.5 | 9.8-13.2 | 194 | 165-224 |
| LT | 0.6 | 0.4-0.7 | 205 | 158-251 |
| LU | 0.2 | 0.2-0.2 | 288 | 245-332 |
| LV | 0.4 | 0.3-0.4 | 194 | 158-230 |
| MT | 0.1 | 0.1-0.2 | 206 | 128-284 |
| NL | 3.3 | 2.8-3.8 | 189 | 161-218 |

[3] Because of unavailable data for IE for 2022, Eurostat (2025f) 2020 data was used.

| | | | | |
|---|---|---|---|---|
| **PL** | 6.9 | 4.6-9.3 | 185 | 124-247 |
| **PT** | 2.2 | 1.8-2.5 | 208 | 173-244 |
| **RO** | 3.6 | 2.0-5.2 | 187 | 103-271 |
| **SE** | 1.9 | 1.4-2.4 | 180 | 134-226 |
| **SI** | 0.5 | 0.3-0.6 | 215 | 166-264 |
| **SK** | 1.1 | 0.9-1.3 | 199 | 163-235 |
| **EU** | **95.1** | **77.8-112.4** | **216** | **172-261** |

**The total quantity of bio-waste generated in the EU in 2022 is estimated to be between 78 and 112 Mt**. Figure 16 visualises the MS with the highest bio-waste generation quantities, showing that Germany, France and Italy produce the most bio-waste, respectively having a share of 21%, 15% and 12%. Evaluated based on the number of inhabitants shows that Austria, Belgium and Germany are the countries producing the most bio-waste per inhabitant.

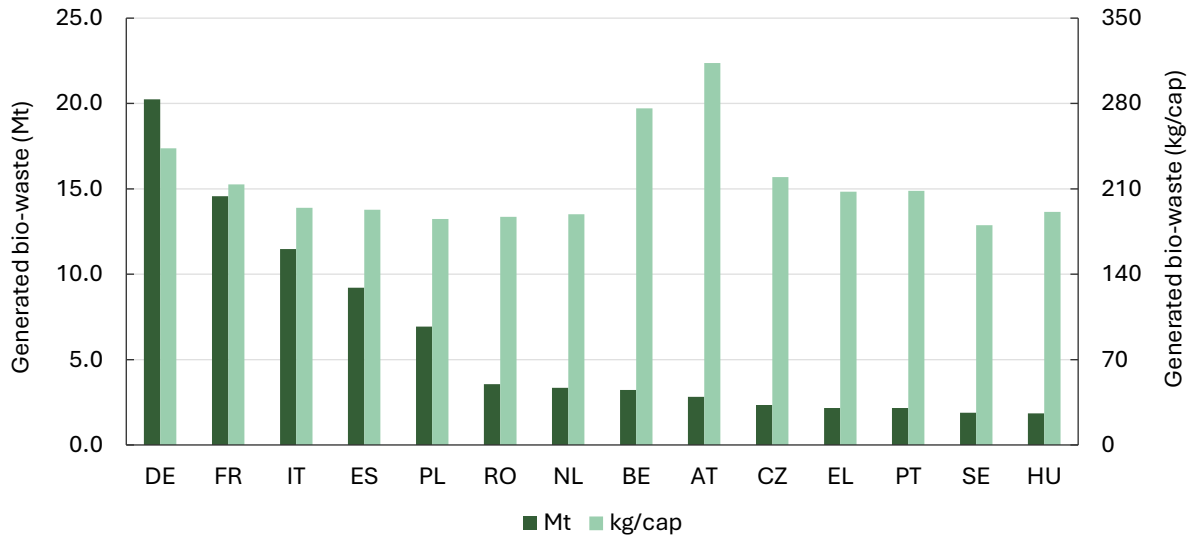



*Figure 16: Quantities of generated bio-waste for the most producing MS in 2022.*

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### 3.1.2 Separately collected bio-waste

ECN (2022) provides bio-waste collected data for several countries for households, commercial and industrial, which matches the BIC (2024) and Eurostat (2025f) data for each MS. Table 12 provides ranges of separately collected bio-waste per MS based on the last two mentioned references, and Figure 17 visualises the MS with the highest bio-waste collection quantities.

*Table 12: Separately collected bio-waste in 2022 (sources: BIC, 2024; Eurostat, 2025f).*

| Country | Bio-waste collected in 2022 (Mt) | | Bio-waste collected in 2022 (kg/cap) | |
|---|---|---|---|---|
| | Midpoint | Range | Midpoint | Range |
| **AT** | 1.5 | 1.5-1.6 | 169 | 163-174 |
| **BE** | 1.7 | 1.6-1.8 | 144 | 135-152 |
| **BG** | 0.1 | 0.1-0.1 | 13 | 10-15 |
| **CY** | 0.0 | 0.0-0.0 | 11 | 11-11 |
| **CZ** | 0.8 | 0.8-0.9 | 78 | 73-83 |
| **DE** | 11.8 | 11.2-12.4 | 142 | 134-149 |
| **DK** | 1.1 | 1.1-1.2 | 192 | 181-202 |
| **EE** | 0.0 | 0.0-0.0 | 22 | 15-28 |
| **EL** | 0.2 | 0.1-0.4 | 23 | 7-39 |
| **ES** | 5.0 | 5.0-5.0 | 106 | 105-106 |
| **FI** | 0.4 | 0.4-0.4 | 77 | 77-77 |
| **FR** | 6.7 | 6.4-7.0 | 99 | 94-104 |
| **HR** | 0.1 | 0.1-0.1 | 24 | 24-24 |
| **HU** | 0.3 | 0.3-0.4 | 36 | 32-39 |
| **IE** | 0.3 | 0.3-0.3 | 66 | 66-66 |
| **IT** | 7.1 | 7.0-7.3 | 121 | 118-123 |
| **LT** | 0.3 | 0.3-0.3 | 102 | 102-102 |
| **LU** | 0.1 | 0.1-0.1 | 186 | 171-200 |
| **LV** | 0.1 | 0.1-0.1 | 58 | 37-79 |
| **MT** | 0.0 | 0.0-0.0 | 26 | 0-52 |
| **NL** | 2.6 | 2.5-2.7 | 147 | 139-154 |
| **PL** | 1.9 | 1.9-2.0 | 52 | 52-52 |
| **PT** | 0.9 | 0.9-0.9 | 87 | 86-87 |
| **RO** | 0.3 | 0.3-0.3 | 15 | 15-15 |
| **SE** | 0.8 | 0.8-0.9 | 79 | 75-82 |
| **SI** | 0.2 | 0.2-0.2 | 78 | 78-78 |
| **SK** | 0.4 | 0.4-0.4 | 79 | 79-79 |
| **EU** | **45.0** | **43.2-46.8** | **82** | **77-88** |

The total quantity of **separately collected bio-waste generated in the EU in 2022** is estimated to be between **43 and 47 Mt**. Figure 17 shows that Germany, Italy and France have the highest absolute quantities of separately collected bio-waste. Evaluated per capita (kg/cap), shows that Belgium, Germany and Poland collect the most bio-waste. Figure 18 shows the range of bio-waste capture rates across the twelve MS with the highest capture rates.

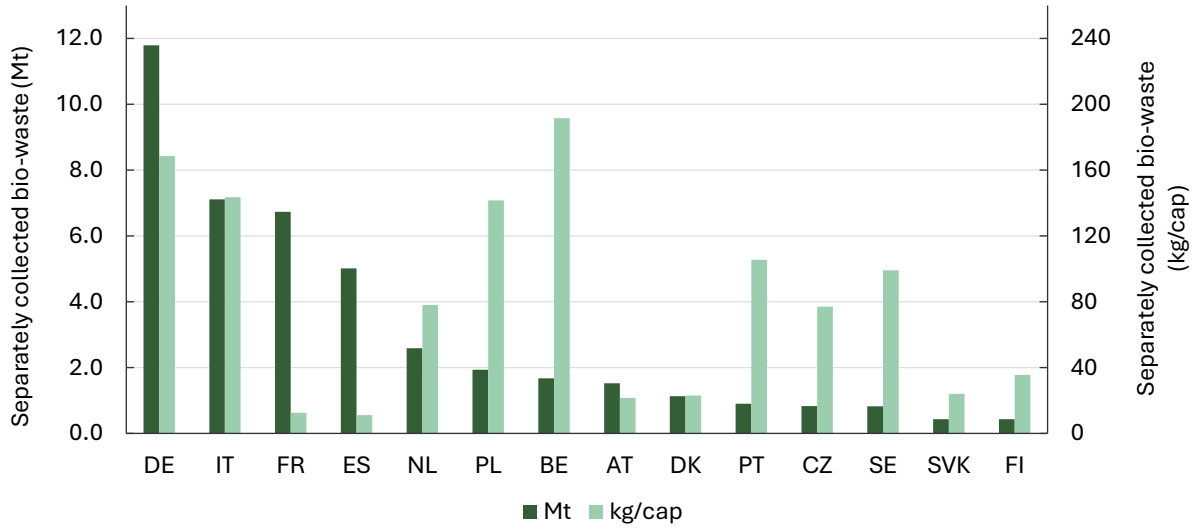



*Figure 17: Quantities of separately collected bio-waste for the most collecting MS in 2022.*

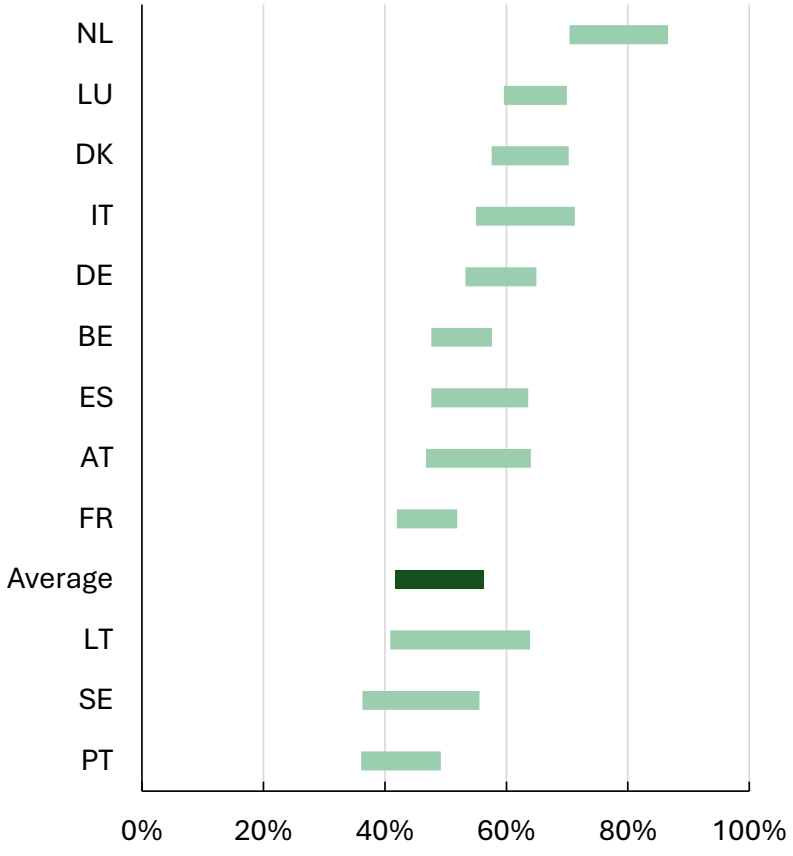



*Figure 18: Bio-waste collected separately as share of the bio-waste generated for the twelve highest MS and the average of EU in 2022.*

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### 3.1.3 Bio-waste not separately collected

The bio-waste that is not separately collected but is a part of integrally collected MSW, represents the bio-waste lost to the mixed waste stream and is therefore useful to estimate the potential feedstock that is now lost. This data can be estimated by the difference between the generated bio-waste and the separately collected bio-waste and is reported in Table 13. **The total not separately collected bio-waste that is part of the integrally collected MSW is estimated between 31 and 69 Mt**.

*Table 13: Not separately collected bio-waste in 2022 (sources: BIC, 2024; Eurostat, 2025f).*

| Country | Bio-waste not separately collected (Mt) | | Bio-waste not separately collected (kg/cap) | |
|---|---|---|---|---|
| | Midpoint | Range | Midpoint | Range |
| **AT** | 1.3 | 0.7 - 1.9 | 145 | 83 - 206 |
| **BE** | 1.6 | 1.0 - 2.1 | 133 | 83 - 182 |
| **BG** | 1.2 | 1.0 - 1.4 | 183 | 151 - 214 |
| **CY** | 0.2 | 0.1 - 0.3 | 198 | 107 - 290 |
| **CZ** | 1.5 | 1.1 - 1.9 | 142 | 104 - 180 |
| **DE** | 8.5 | 4.8 - 12.1 | 102 | 58 - 146 |
| **DK** | 0.7 | 0.3 - 1.0 | 112 | 56 - 168 |
| **EE** | 0.2 | 0.1 - 0.3 | 148 | 99 - 198 |
| **EL** | 1.9 | 1.4 - 2.4 | 185 | 137 - 232 |
| **ES** | 4.2 | 2.8 - 5.6 | 87 | 58 - 117 |
| **FI** | 0.7 | 0.6 - 0.9 | 132 | 100 - 163 |
| **FR** | 7.8 | 5.4 - 10.3 | 115 | 78 - 152 |
| **HR** | 0.7 | 0.5 - 0.8 | 170 | 139 - 201 |
| **HU** | 1.5 | 1.0 - 2.1 | 156 | 99 - 212 |
| **IE** | 0.9 | 0.9 - 0.9 | 189 | 151 - 227 |
| **IT** | 4.4 | 2.5 - 6.2 | 74 | 42 - 106 |
| **LT** | 0.3 | 0.2 - 0.4 | 103 | 56 - 149 |
| **LU** | 0.1 | 0.0 - 0.1 | 103 | 45 - 161 |
| **LV** | 0.3 | 0.1 - 0.4 | 136 | 79 - 193 |
| **MT** | 0.1 | 0.0 - 0.2 | 180 | 76 - 284 |
| **NL** | 0.8 | 0.1 - 1.4 | 43 | 7 - 79 |
| **PL** | 5.0 | 2.6 - 7.4 | 133 | 72 - 195 |
| **PT** | 1.3 | 0.9 - 1.6 | 122 | 86 - 158 |
| **RO** | 3.3 | 1.7 - 4.9 | 172 | 88 - 256 |
| **SE** | 1.1 | 0.6 - 1.6 | 102 | 52 - 151 |
| **SI** | 0.3 | 0.2 - 0.4 | 137 | 88 - 186 |
| **SK** | 0.7 | 0.5 - 0.8 | 120 | 84 - 156 |
| **EU** | **50.1** | **31.0 - 69.3** | **134** | **84 - 184** |

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## 3.2 Food waste

### 3.2.1 Food waste generated

Food waste, as part of bio-waste, is reported by Eurostat (*env_wasfw*), BIC (2024) and EEA (2020). Eurostat separately states the food waste **generated** for the following categories: Total (aggregate changing according to the context), Primary production of food – agriculture, fishing and aquaculture, Manufacture of food products and beverages, Retail and other distribution of food, Restaurants and food services, and Total activities by households (Eurostat, 2025e). BIC (2024) reports the food waste as part of the bio-waste, whereas EEA (2020) reports the percentages of food waste, garden waste and other waste within the bio-waste. Therefore, based on the previously calculated bio-waste volumes, the food waste generation can be estimated and is shown in Table 14. **The total generated food waste in EU is estimated between 40 and 70 Mt**.

*Table 14: Food waste generated in 2022 (sources: EEA, 2020; BIC, 2024; Eurostat, 2025e).*

| Country | Food waste generated (Mt) | | Food waste generated (kg/cap) | |
|---|---|---|---|---|
| | Midpoint | Range | Midpoint | Range |
| **AT** | 1.1 | 1.1 - 1.2 | 125 | 119 - 131 |
| **BE** | 1.3 | 0.8 - 1.8 | 112 | 72 - 151 |
| **BG** | 0.7 | 0.5 - 0.8 | 100 | 80 - 121 |
| **CY** | 0.2 | 0.1 - 0.3 | 182 | 80 - 284 |
| **CZ** | 0.9 | 0.7 - 1.1 | 84 | 66 - 101 |
| **DE** | 10.0 | 7.9 - 12.2 | 120 | 94 - 146 |
| **DK** | 1.3 | 0.6 - 1.9 | 215 | 104 - 326 |
| **EE** | 0.2 | 0.1 - 0.2 | 144 | 109 - 180 |
| **EL** | 1.9 | 1.5 - 2.3 | 182 | 143 - 222 |
| **ES** | 5.9 | 3.1 - 8.7 | 124 | 65 - 184 |
| **FI** | 0.8 | 0.6 - 1.0 | 142 | 102 - 183 |
| **FR** | 7.3 | 5.3 - 9.4 | 108 | 78 - 138 |
| **HR** | 0.5 | 0.3 - 0.6 | 125 | 84 - 166 |
| **HU** | 0.7 | 0.3 - 1.1 | 70 | 30 - 110 |
| **IE** | 0.8 | 0.6 - 0.9 | 152 | 118 - 186 |
| **IT** | 7.9 | 6.7 - 9.0 | 133 | 113 - 153 |
| **LT** | 0.3 | 0.2 - 0.4 | 99 | 57 - 140 |
| **LU** | 0.1 | 0.1 - 0.1 | 165 | 118 - 212 |
| **LV** | 0.2 | 0.2 - 0.3 | 117 | 95 - 138 |
| **MT** | 0.1 | 0.1 - 0.1 | 195 | 113 - 277 |
| **NL** | 2.1 | 1.8 - 2.5 | 122 | 103 - 140 |
| **PL** | 4.4 | 2.9 - 6.0 | 118 | 78 - 158 |
| **PT** | 1.6 | 1.3 - 1.9 | 156 | 127 - 184 |
| **RO** | 2.4 | 1.3 - 3.5 | 125 | 69 - 181 |
| **SE** | 1.5 | 1.1 - 1.9 | 144 | 106 - 182 |
| **SI** | 0.2 | 0.2 - 0.3 | 114 | 71 - 157 |
| **SK** | 0.6 | 0.5 - 0.7 | 104 | 84 - 124 |
| **EU** | **55** | **39.7 - 70.2** | **132** | **92 - 173** |

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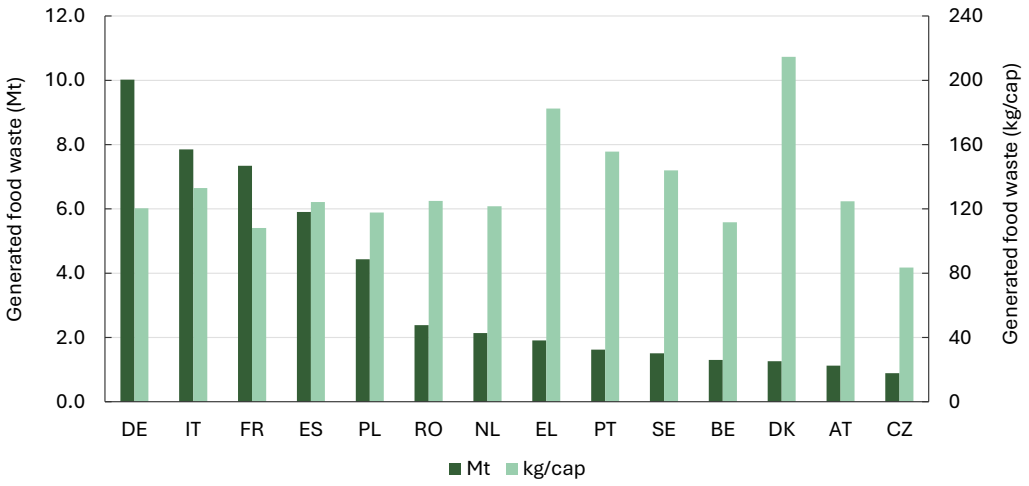



*Figure 19: Quantities of generated food waste for the most food waste producing MS in 2022.*

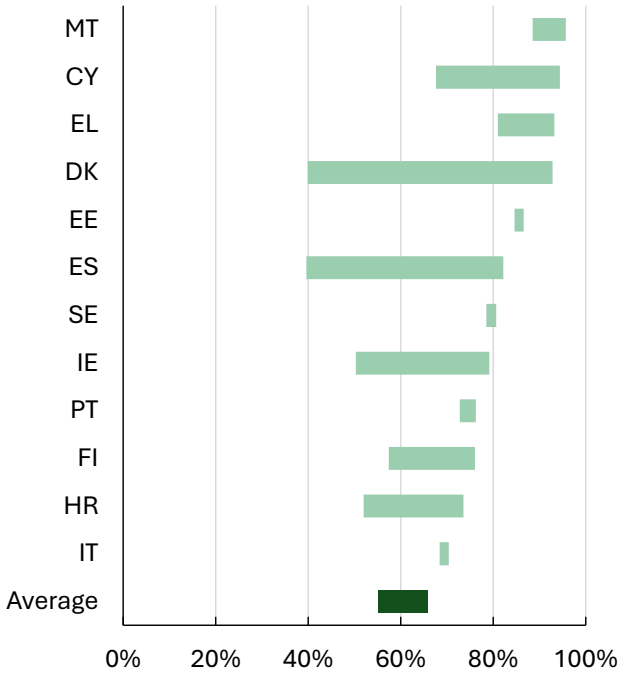



*Figure 20: Share of food waste in bio-waste in 2022.*

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### 3.2.2 Food waste collected

BIC (2024) reported the estimated bio-waste collected and the percentage of food waste in the collected bio-waste per MS. Based on these shares and the calculated quantities of the separately collected bio-waste (Table 12), an estimate of the food waste within the separately collected bio-waste is calculated and shown in Table 15.

*Table 15: Food waste within the collected bio-waste estimation (source: BIC, 2024).*

| Country | Share of food waste in collected bio-waste (BIC, 2024) | Food waste collected in 2022 (Mt) | | Food waste collected in 2022 (kg/cap) | |
|---|---|---|---|---|---|
| | | Midpoint | Range | Midpoint | Range |
| **AT** | 20% | 0.3 | 0.3 - 0.3 | 33.9 | 32.9 - 34.8 |
| **BE** | 20% | 0.3 | 0.3 - 0.4 | 28.8 | 27.2 - 30.4 |
| **BG** | 0% | 0.0 | 0.0 - 0.0 | 0.0 | 0.0 - 0.0 |
| **CY** | 20% | 0.0 | 0.0 - 0.0 | 2.2 | 2.2 - 2.2 |
| **CZ** | 20% | 0.2 | 0.2 - 0.2 | 15.8 | 14.6 - 16.9 |
| **DE** | 20% | 2.4 | 2.2 - 2.5 | 28.3 | 26.9 - 29.8 |
| **DK** | 25% | 0.3 | 0.3 - 0.3 | 48.0 | 45.5 - 50.5 |
| **EE** | 20% | 0.0 | 0.0 - 0.0 | 4.4 | 3.0 - 5.7 |
| **EL** | 20% | 0.0 | 0.0 - 0.1 | 4.6 | 1.4 - 7.8 |
| **ES** | 20% | 1.0 | 1.0 - 1.0 | 21.1 | 21.0 - 21.3 |
| **FI** | 20% | 0.1 | 0.1 - 0.1 | 15.4 | 15.4 - 15.4 |
| **FR** | 20% | 1.3 | 1.3 - 1.4 | 19.9 | 19.0 - 20.8 |
| **HR** | 20% | 0.0 | 0.0 - 0.0 | 4.8 | 4.8 - 4.8 |
| **HU** | 20% | 0.1 | 0.1 - 0.1 | 7.1 | 6.4 - 7.8 |
| **IE** | 20% | 0.1 | 0.1 - 0.1 | 13.2 | 13.2 - 13.2 |
| **IT** | 75% | 5.3 | 5.2 - 5.4 | 90.3 | 88.3 - 92.3 |
| **LT** | 20% | 0.1 | 0.1 - 0.1 | 20.5 | 20.4 - 20.5 |
| **LU** | 20% | 0.0 | 0.0 - 0.0 | 37.4 | 34.7 - 40.0 |
| **LV** | 20% | 0.0 | 0.0 - 0.0 | 11.6 | 7.4 - 15.8 |
| **MT** | 83% | 0.0 | 0.0 - 0.0 | 21.6 | 0.0 - 43.2 |
| **NL** | 20% | 0.5 | 0.5 - 0.5 | 29.4 | 28.0 - 30.8 |
| **PL** | 20% | 0.4 | 0.4 - 0.4 | 10.2 | 10.1 - 10.4 |
| **PT** | 20% | 0.2 | 0.2 - 0.2 | 17.4 | 17.2 - 17.6 |
| **RO** | 20% | 0.1 | 0.1 - 0.1 | 3.0 | 3.0 - 3.1 |
| **SE** | 20% | 0.2 | 0.2 - 0.2 | 15.7 | 15.0 - 16.4 |
| **SI** | 20% | 0.0 | 0.0 - 0.0 | 15.6 | 15.6 - 15.7 |
| **SK** | 20% | 0.1 | 0.1 - 0.1 | 15.8 | 15.8 - 15.8 |
| **EU** | | **13.0** | **12.5 - 13.4** | **19.9** | **18.1 - 21.6** |

**The total food waste collected in EU is estimated between 12.5 and 13.4 Mt**. Figure 21 shows that Italy, Germany and France collect the most food waste in absolute quantities, whereas Italy, Denmark and Austria collect the most food waste per capita. Figure 22 shows the range of estimated food waste collected share compared to the total food waste generated (Table 14).

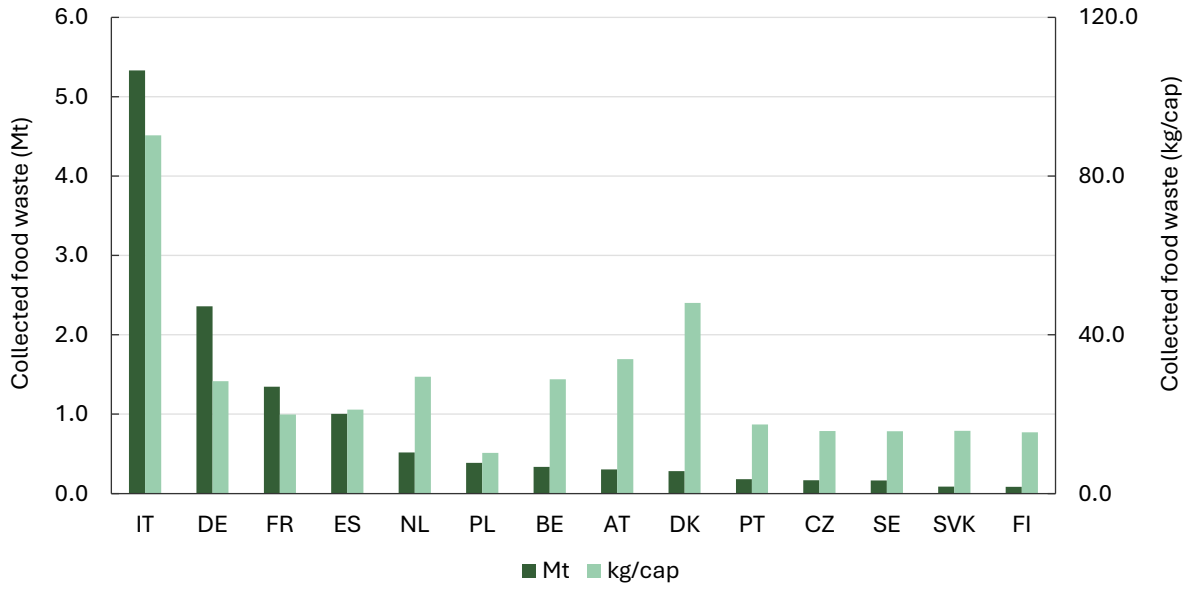



*Figure 21: Quantities of collected food waste for the most food waste collecting MS in 2022.*

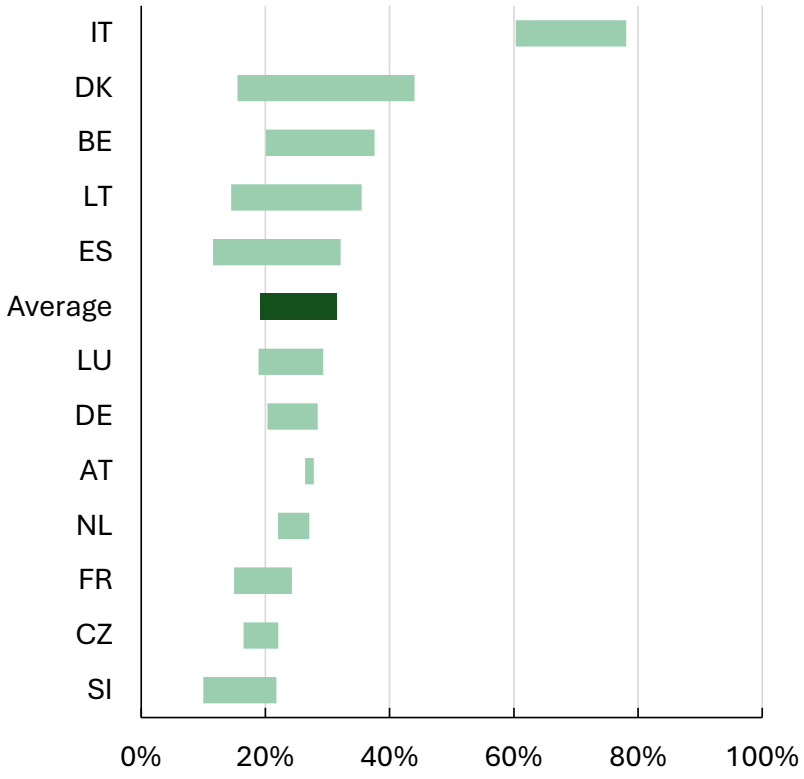



*Figure 22: Share of food waste collected in the food waste generated.*

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## 3.3 Garden waste

If the definition of BIC (2024) is that bio-waste is roughly the sum of food waste and garden waste, and the (approximate) values for bio-waste and food waste are known, the garden waste quantities can be calculated. Also, as mentioned, EEA (2020) reports the percentage of food waste, garden waste and other waste in the bio-waste. Taking these two methods gives an estimation of the generated garden waste, as shown in Table 16.

*Table 16: Garden waste generated (source: EEA, 2020; BIC, 2024; Eurostat 2025f).*

| Country | Garden waste generated (Mt) | | Garden waste generated (kg/cap) | |
|---|---|---|---|---|
| | Midpoint | Range | Midpoint | Range |
| AT | 2.0 | 1.2 - 2.7 | 217 | 139 - 296 |
| BE | 1.7 | 1.4 - 1.9 | 143 | 121 - 164 |
| BG | 0.6 | 0.5 - 0.8 | 93 | 68 - 119 |
| CY | 0.1 | 0.0 - 0.1 | 61 | 34 - 89 |
| CZ | 1.4 | 1.2 - 1.6 | 135 | 115 - 156 |
| DE | 9.6 | 8.2 - 11.1 | 116 | 98 - 133 |
| DK | 0.6 | 0.1 - 1.0 | 94 | 19 - 170 |
| EE | 0.1 | 0.0 - 0.1 | 58 | 15 - 101 |
| EL | 0.3 | 0.1 - 0.5 | 31 | 12 - 49 |
| ES | 1.7 | 1.4 - 2.0 | 36 | 29 - 43 |
| FI | 0.4 | 0.1 - 0.7 | 72 | 18 - 125 |
| FR | 7.3 | 6.2 - 8.4 | 108 | 91 - 124 |
| HR | 0.3 | 0.2 - 0.5 | 90 | 40 - 141 |
| HU | 1.0 | 0.7 - 1.3 | 104 | 74 - 134 |
| IE | 0.4 | 0.2 - 0.6 | 78 | 39 - 117 |
| IT | 2.9 | 2.5 - 3.4 | 49 | 42 - 57 |
| LT | 0.3 | 0.2 - 0.4 | 96 | 62 - 130 |
| LU | 0.1 | 0.1 - 0.1 | 125 | 92 - 159 |
| LV | 0.1 | 0.1 - 0.2 | 75 | 27 - 123 |
| MT | 0.0 | 0.0 - 0.0 | 10 | 6 - 15 |
| NL | 1.0 | 0.2 - 1.7 | 55 | 13 - 97 |
| PL | 3.4 | 1.6 - 5.1 | 89 | 44 - 135 |
| PT | 0.8 | 0.4 - 1.2 | 77 | 38 - 117 |
| RO | 1.7 | 0.7 - 2.7 | 89 | 34 - 143 |
| SE | 0.8 | 0.3 - 1.3 | 73 | 26 - 120 |
| SI | 0.2 | 0.1 - 0.3 | 109 | 62 - 156 |
| SK | 0.6 | 0.4 - 0.8 | 114 | 77 - 151 |
| **EU** | **39.3** | **28.1 - 50.6** | **2,399** | **53 - 125** |

**The total generated garden waste in EU is estimated between 28 and 51 Mt**. Figure 23 shows that Italy, Germany and France produce the most garden waste, whereas the Netherlands, Austria and Denmark produce the most garden waste per inhabitant.

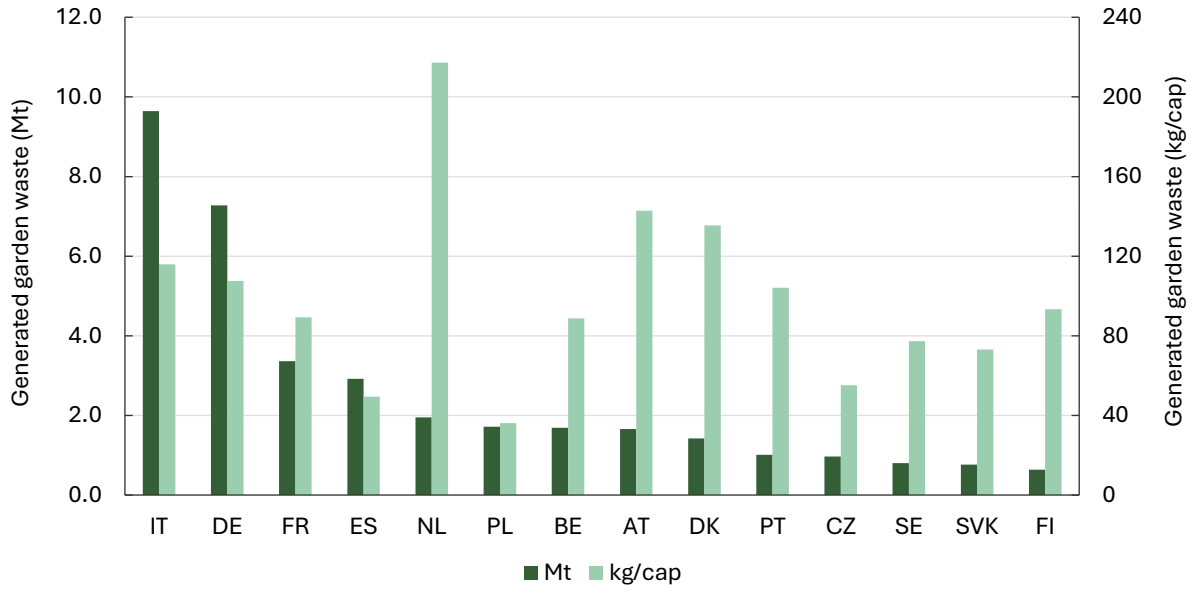



*Figure 23: Quantities of garden waste for the most garden waste producing MS in 2022.*

## 3.4 Composted MSW

Eurostat *env_wasmun* (2025f) reports the amount of municipal waste composted and digested from municipal waste streams, it excludes industrial bio-waste and agricultural residues. The following definition of municipal waste is used by the EU "*Municipal waste is mainly produced by households, similar wastes from sources such as commerce, offices and public institutions are included*." (Eurostat, 2022). This definition also includes garden waste and waste from park and garden maintenance. ECN (2022) reports data on the amount of composted bio-waste and digested bio-waste for 2019. These values cover municipal and commercial/industrial separately collected bio-waste. Comparing these two references shows some large differences (underlined and coloured in Table 17).

In Belgium, Eurostat significantly under-reports the composted and digested waste, especially because ECN reports only the Flanders region of Belgium, thus excluding Wallonia and Brussels. According to Belgium's national reporting, in 2022, 127 kg/capita is composted and fermented (STATBEL, 2025).

According to ECN (2022), 38.4 Mt/year of municipal bio-waste was composted and digested in the EU, whereas Eurostat (2025f) reports 39.1 Mt/year in 2019 and 43.5 Mt/year in 2022 (see Table 17).

*Table 17: Composted and digested (bio-)waste in Eurostat (2025f) and according to ECN (2022).*

| Country | Composted and digested waste in 2019 (Eurostat, 2025f) (kt) | Composted and digested waste in 2019 (Eurostat, 2025f) (kg/capita) | Composted and digested bio-waste in 2019(ECN, 2022) (kg/capita/yr)[4] | Separately collected and composted bio-waste in 2019 (ECN, 2022) (kg/capita/yr) | Separately collected and digested bio-waste in 2019 (ECN, 2022) (kg/capita/yr) |
|---|---|---|---|---|---|
| **AT** | 1,677 | **189** | 226 | 146 | 80 |
| **BE** | 982 | **86** | 383 | 151 | 232 |
| **BG** | 238 | **36** | | | |
| **CY** | 8 | **9** | | | |
| **CZ** | 602 | **56** | | | |
| **DE** | 9,442 | **114** | 163 | 108 | 55 |
| **DK** | 882 | **152** | | | |
| **EE** | 12 | **9** | | | |
| **EL** | 283 | **26** | | | |
| **ES** | 4,072 | **86** | 58 | 44 | 14 |
| **FI** | 442 | **80** | 67 | 43 | 24 |
| **FR** | 6,992 | **104** | | | |
| **HR** | 63 | **16** | | | |
| **HU** | 353 | **36** | | | |
| **IE** | 295 | **59** | 47 | 31 | 16 |
| **IT** | 6,387 | **107** | 119 | 112 | 7 |
| **LT** | 293 | **104** | 43 | 41 | 2 |
| **LU** | 94 | **152** | 194 | 73 | 121 |
| **LV** | 42 | **22** | | | |
| **MT** | 0 | **0** | | | |
| **NL** | 2,569 | **148** | 139 | 108 | 31 |
| **PL** | 1,153 | **30** | | | |
| **PT** | 883 | **85** | | | |
| **RO** | 239 | **12** | | | |
| **SE** | 653 | **64** | **85** | 29 | 56 |
| **SI** | 176 | **84** | | | |
| **SK** | 269 | **49** | | | |
| **EU** | **39,101** | | | | |

[4] Calculation by adding the composted bio-waste and the digested bio-waste.

## 3.5 Availability at site level

ECN reports data on the capacity per composting and digestion facility, and the number of capita per facility, see ECN (2022). In total there are 5,800 bio-waste treatment facilities, 3,800 are composting and 2,000 are anaerobic digestion (ECN, 2022).

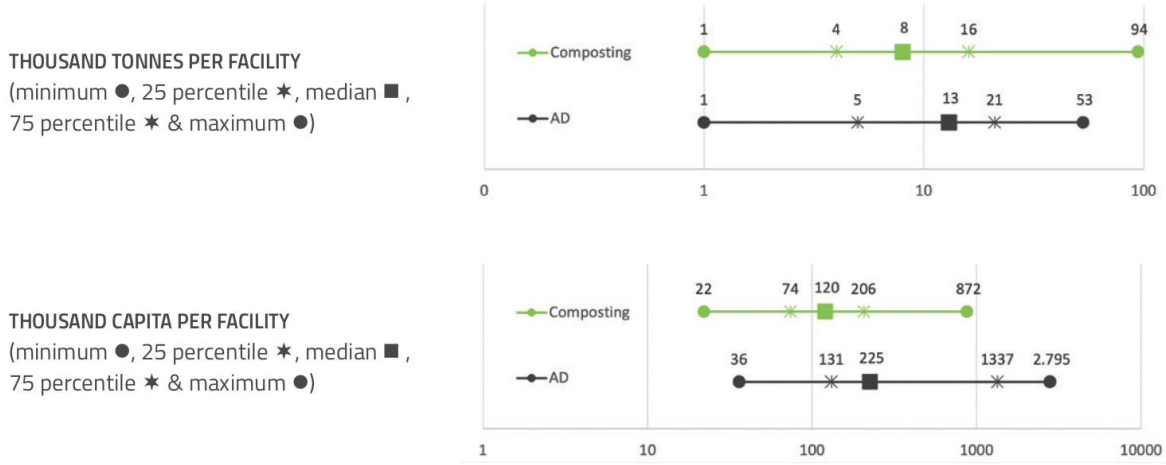



*Figure 24: Capacity of facilities and the capita per facility (from: ECN, 2022).*

# 4 Group 3: Sludges

For the production of fertilisers, sludges can be used to recover the nutrients. In this chapter, we distinguish three categories of sludges: sewage sludge from urban wastewater treatment plants, sewage sludge from industrial wastewater treatment plants, and industrial effluent sludges. The urban and industrial wastewater sludges originate from wastewater treatment plants, whereas the industrial effluent sludges are a more diverse stream of waste from several industry sources.

No equivalence is assumed between the three sludge categories in terms of nutrient content, organic matter or contaminant load, and the reported quantities are not aggregated into one total value. Suitability for use in fertilising products is determined by composition rather than by volume. The composition and safety of the fertilising products derived from these feedstocks, including contaminants, are assessed in D4.1 and D4.2.

## 4.1 Sewage sludge from urban wastewater treatment plants

Eurostat (*env_ww_spd*) provides numbers for sludge production from urban wastewater treatment plants and a division of sludge disposal into several categories, reported in dry matter (DM), see Table 18 and Figure 25 (Eurostat, 2025g)[5]. Sludge disposal via dumping at sea has not been reported for any of the MS. All sludge quantities in this chapter are expressed in ktonnes of dry matter, in line with Eurostat reporting basis. Reported quantities are therefore independent of the amount of dewatering applied at individual plants. For the assessment of transport, storage and installation sizing, fresh matter rather than dry mass is the determining quantity, and this varies depending on the treatment stage. Where fresh matter is relevant for the technologies assessed in this project, it should be derived from the dry matter quantities using plant-specific dry matter contents rather than by application of a single European average.

*Table 18: Sewage sludge production from urban WWTP and disposal in 2023 in kt DM (Eurostat 2025g).*

| Country | Sludge production | Sludge disposal – total | Sludge disposal – agriculture | Sludge disposal – compost/other | Sludge disposal – incineration | Sludge disposal – landfill | Sludge disposal – other |
|---|---|---|---|---|---|---|---|
| **AT** | **197** | **197** | 50 | 38 | 85 | 0.2 | 24 |
| **BE** | **N/A** | **153** | 33 | 0 | 117 | 0 | 3 |
| **BG** | **58** | **46** | 19 | 20 | 0 | 1 | 6 |
| **CY** | **9** | **9** | 1 | 5 | 0.3 | 0 | 2 |
| **CZ** | **220** | **220** | 73 | 103 | 20 | 24 | N/A |
| **DE** | **1,629** | **1,630** | 213 | 84 | 1,320 | 0 | 13 |
| **DK** | **N/A** | **151** | 88 | 35 | 23 | 5 | 0 |
| **EE** | **37** | **21** | 19 | 2 | N/A | 0 | N/A |
| **EL** | **99** | **99** | 5 | 19 | 37 | 29 | 10 |
| **ES** | **767** | **767** | 663 | N/A | 47 | 27 | 30 |
| **FI** | **142** | **142** | 56 | 83 | 1 | 0.3 | 1 |
| **FR** | **1,143** | **1,172** | 435 | 564 | 150 | 2 | 21 |
| **HR** | **45** | **45** | 0.1 | 0 | 0.01 | 1 | 44 |
| **HU** | **245** | **193** | 11 | 170 | 11 | 2 | 0 |
| **IE** | **59** | **59** | 53 | 6 | 0 | 0 | 0 |
| **IT** | **N/A** | **N/A** | N/A | N/A | N/A | N/A | N/A |
| **LT** | **41** | **42** | 15 | 19 | 8 | 0 | 0 |
| **LU** | **10** | **10** | 1 | 0 | 2 | 0 | 7 |

[5] For BG, EL, ES, NL and SE 2022 data is used and for DK 2019 data. There was no data availability for IT and PT.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **LV** | **21** | **21** | 2 | 2 | 1 | 0 | 16 |
| **MT** | **8** | **8** | 0 | 0 | 0 | 8 | 0 |
| **NL** | **350** | **300** | 0 | 0 | 290 | 1 | 8 |
| **PL** | **550** | **550** | 147 | 23 | 90 | 6 | 284 |
| **PT** | **N/A** | **N/A** | N/A | N/A | N/A | N/A | N/A |
| **RO** | **177** | **177** | 46 | 2 | 11 | 103 | 15 |
| **SE** | **198** | **195** | 107 | 46 | 3 | 1 | 38 |
| **SI** | **27** | **27** | 0 | 0.3 | 6 | 1 | 20 |
| **SK** | **56** | **56** | 0 | 30 | 16 | 10 | 1 |
| **EU** | **6,089** | **6,287** | **2,036** | **1,249** | **1,949** | **220** | **535** |

Digestate from sewage sludge is not calculated separately in this report. AD is a stabilisation step applied within the treatment plant rather than a disposal route, and Eurostat does not distinguish between digested and non-digested sludge. Digested sludge is therefore distributed among the disposal categories reported in Table 18, according to its destination. Thus, the share of reported production that has already passed through AD cannot be determined from the available statistics and reporting a separate digestate stream would therefore risk double counting.

The disposal pathway distribution for the most producing countries is shown in Figure 25, which clearly shows that there are significant differences between MS. Figure 26 shows the absolute quantities of the MS with the highest sludge production.

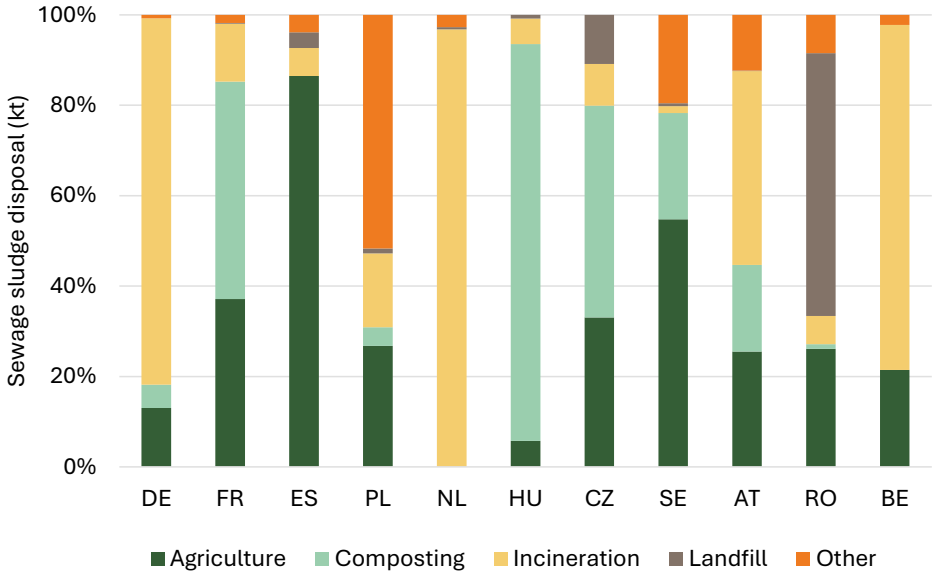



*Figure 25: Sludge disposal pathways in 2023.*

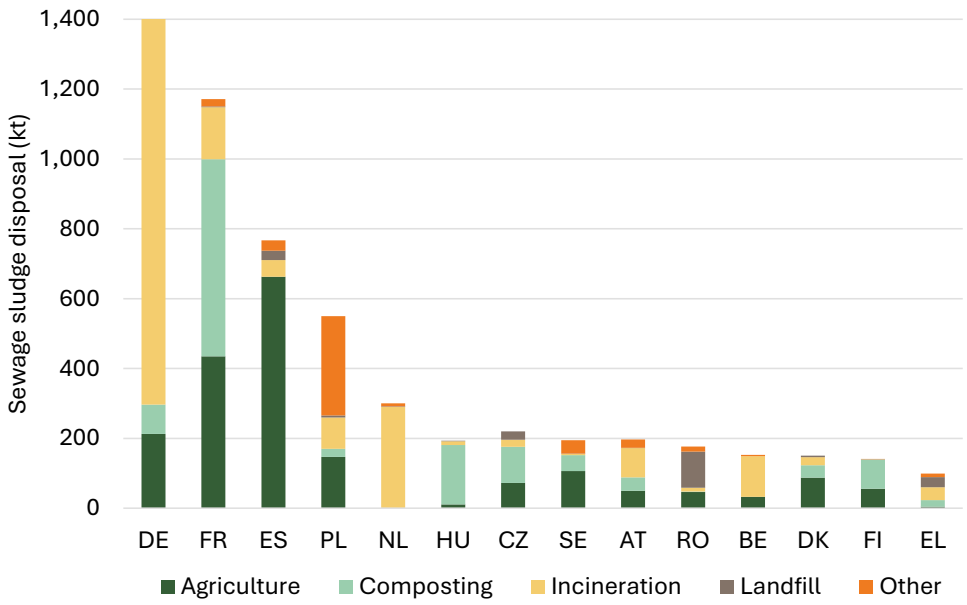



*Figure 26: Sludge potentially available for nutrient recovery in 2023.*

### 4.1.1 Availability at site level

The size of urban wastewater plants depends on their capacity, generally reported in population equivalents. Population equivalent (p.e.) is a fixed number for the average amount of wastewater produced by one individual. Table 19 provides the range of sludge production for small (< 2,000 p.e.), medium (2,000 – 10,000 p.e.), large (10,001 – 100,000 p.e.) and very large (> 100,001 p.e.) wastewater treatment plants in the EU (European Commission, 2024). In EU in 2022, there were 1,219 active plants with < 2,000 p.e., and 19,181 active plants with ≥ 2000 p.e..

*Table 19: Tonnes of sludge production per year per size of wastewater treatment plant in person equivalent (p.e.).*

| < 2,000 p.e. | 2,000 – 10,000 p.e. | 10,001 – 100,000 p.e. | > 100,001 p.e. |
|---|---|---|---|
| 0.01 – 31 | 31-156 | 156-1,564 | > 1,564 |

## 4.2 Sludge from industrial wastewater treatment plants

The same Eurostat database for the urban wastewater treatment plants (*env_ww_spd*) also has an 'other' wastewater treatment plant type, however the reporting of this is voluntary and data is often incomplete. Table 20 states the data from the six MS that have reported their sludge production (Eurostat, 2025g).

*Table 20: Sewage sludge production from other wastewater treatment plants and disposal in different sectors in 2022 per MS (Eurostat 2025g).*

| Country | Sludge production (kt DM) | Sludge disposal – total (kt DM) | Sludge disposal – agriculture (kt DM) | Sludge disposal – compost and other applications (kt DM) | Sludge disposal – incineration (kt DM) | Sludge disposal – landfill (kt DM) | Sludge disposal – other (kt DM) |
|---|---|---|---|---|---|---|---|
| **DE** | **989** | **990** | 37 | 73 | 446 | 147 | 287 |
| **EE** | **10** | **9** | 8 | 0.1 | N/A | 0.2 | N/A |
| **HR** | **9** | **8** | 0.1 | 5 | 0.04 | 1 | 3 |
| **HU** | **27** | **26** | 0.2 | 11 | 7 | 8 | 0 |
| **MT** | **0** | **0** | 0 | 0 | 0 | 0 | 0 |
| **PL** | **432** | **432** | 20 | 2 | 150 | 60 | 200 |
| **RO** | **155** | **155** | 4 | 17 | 12 | 68 | 55 |
| **SI** | **0** | **0** | 0 | 0 | 0 | 0 | 0 |

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## 4.3 Industrial effluents

Eurostat database *env_wastrt* reports industrial effluent sludges (W032) for several waste treatment categories (disposal and recovery), see Table 21 (Eurostat, 2025h). Recovery by backfilling has only been reported by CZ (11,032 tonnes) and LV (46 tonnes).

*Table 21: Industrial effluent sludges waste treatment in 2022 per MS (Eurostat 2025h).*

| Country | Disposal – incineration (kt) | Disposal – landfill (kt) | Disposal – other (kt) | Recovery – energy (kt) | Recovery – recycling (kt) | Total waste treatment (kt) |
|---|---|---|---|---|---|---|
| **AT** | N/A | 6 | 0 | N/A | 10 | **19** |
| **BE** | 3 | 9 | 0 | 111 | 16 | **138** |
| **BG** | 0 | 394 | 0 | 11 | 12 | **417** |
| **CY** | 0 | 0 | 0 | 0 | 3 | **3** |
| **CZ** | 1 | 10 | 1 | 7 | 100 | **130** |
| **DE** | 159 | 144 | N/A | 917 | 180 | **1,403** |
| **DK** | 0 | 0.5 | 0.4 | 9 | 60 | **70** |
| **EE** | 0 | 0.1 | 0 | 0 | 6 | **6** |
| **EL** | 0 | 11 | 0 | 4 | 282 | **297** |
| **ES** | 1 | 458 | 0 | 4 | 62 | **526** |
| **FI** | 3 | 28 | 20 | 46 | 5 | **102** |
| **FR** | 418 | 139 | 0 | 190 | 441 | **1,188** |
| **HR** | 0 | 1 | 0.02 | 0 | 4 | **5** |
| **HU** | 2 | 7 | 0 | 21 | 33 | **63** |
| **IE** | 0 | 0 | 0 | 12 | 9 | **21** |
| **IT** | 4 | 280 | 0 | 3 | 524 | **811** |
| **LT** | 0.02 | 0 | 0.5 | 0.1 | 5 | **6** |
| **LU** | 0 | 0 | 0 | 0 | 0 | **0** |
| **LV** | 0 | 0.05 | 0 | 0 | 0.2 | **0.3** |
| **MT** | 0 | 0 | 0 | 0 | 0 | **0** |
| **NL** | 10 | 63 | 46 | 118 | 59 | **296** |
| **PL** | 8 | 38 | 0 | 23 | 150 | **219** |
| **PT** | 0 | 95 | 0 | 8 | 81 | **184** |
| **RO** | 4 | 40 | 0 | 42 | 2 | **87** |
| **SE** | N/A | 11 | 0 | N/A | 63 | **137** |
| **SI** | 0.3 | 2 | 0 | 12 | 7 | **21** |
| **SK** | 2 | 30 | 2 | 4 | 26 | **64** |
| **EU** | **613** | **1,766** | **69** | **1,544** | **2,141** | **6,214** |

As visible, also from Figure 27, the industrial effluent sludges are most produced in Germany, France, Italy and Spain, which are also the Member States with the highest output value of the EU agricultural industry (European Commission, 2025).

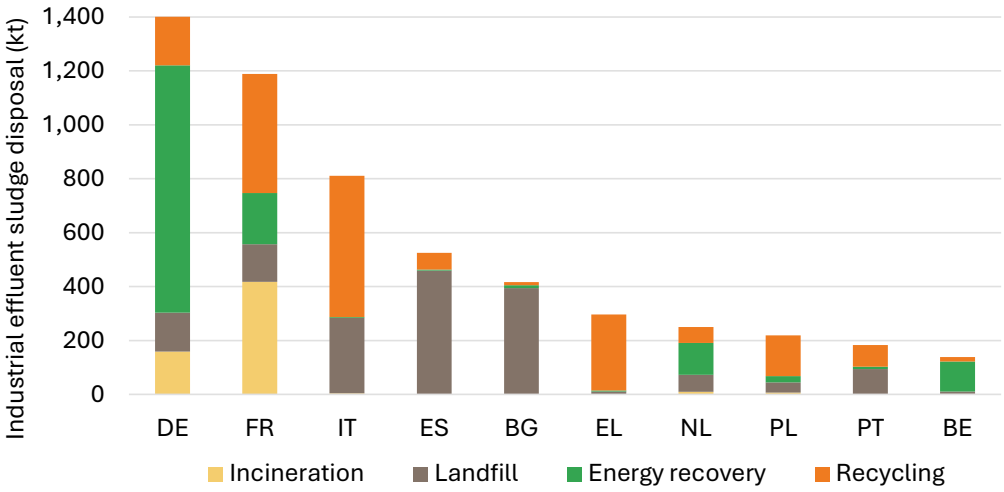



*Figure 27: Industrial effluent sludge disposal pathways in 2022.*

# 5 Group 5: Lignocellulosic and other biomass

In this chapter the availability of lignocellulosic biomass is described, mainly woody and agricultural biomass not described in group 1 to 4.

## 5.1 Woody biomass

In this chapter an indication is given of the availability and possible mobilization of stemwood and forest residues. The Annex 2 report of the recently published study *"Development of outlook for the necessary means to build industrial capacity for drop-in advanced biofuels"* (WUR 2024), in which BTG participated, provides information on the technical potential and availability of biomass as low, medium and high mobilization scenarios in 2030.

- The technical potential is determined by the forest area available for wood supply, excluding protected areas. The yield is determined according to regional management guidelines for age limits for thinnings and final fellings. It considers only technical constraints on residue and stump extraction, and competing uses are not considered.
- All mobilization scenarios consider local extraction constraints according to site productivity, slope, soil and water protection, biodiversity, soil bearing capacity. Moreover, they assume an increase in protected forest by 5%, an increase in retained trees by 5%, and no stump extraction. Moreover, a 5% deduction has been applied for constraints in mobilization.
- For forestry residues, no further distinction was made between the low, medium and high mobilization scenarios.
- For stemwood, in the low mobilization scenario all roundwood production for material use was subtracted from the potential; in the medium mobilization scenario the production of wood for the pulp and paper industry is included in the potential; and in the high mobilization scenario all roundwood is included.

In all mobilization scenarios sustainable forestry and harvesting is applied. In case of stemwood, the main difference between the scenarios is in the degree competing use of the stemwood is considered. WUR (2024) the potentials of stemwood and primary forestry residues are presented, in order of declining mobilization of forestry residues. In Table 22 the potentials of stemwood and primary forestry residues are presented, in order of declining mobilization of forestry residues.

*Table 22: Availability of stemwood and forestry residues in low, medium and high mobilization scenarios in kt dry biomass (source: WUR, 2024; Annex 2, report on task 4, p 80-81).*

| | | Stemwood | | | | Forestry residues | |
|---|---|---|---|---|---|---|---|
| # | Country | low | medium | high | technical potential | All mobilization scenarios | Technical potential |
| 1 | France | 7,327 | 13,622 | 24,429 | 37,584 | 4,568 | 10,914 |
| 2 | Sweden | 1,884 | 11,149 | 27,414 | 42,175 | 4,330 | 13,048 |
| 3 | Germany | 5,692 | 13,456 | 27,404 | 42,161 | 2,667 | 14,282 |
| 4 | Finland | 0 | 9,055 | 19,432 | 29,896 | 2,510 | 10,592 |
| 5 | Portugal | 399 | 4,109 | 4,737 | 7,288 | 2,255 | 2,610 |
| 6 | Spain | 2,070 | 4,880 | 6,455 | 9,931 | 2,061 | 4,241 |
| 7 | Czech Republic | 293 | 1,682 | 6,088 | 9,366 | 1,998 | 3,626 |
| 8 | Romania | 522 | 1,673 | 8,733 | 13,435 | 1,805 | 3,826 |
| 9 | Poland | 0 | 3,720 | 12,193 | 18,759 | 1,733 | 5,489 |
| 10 | Italy | 4,893 | 6,284 | 7,676 | 11,809 | 1,680 | 3,341 |
| 11 | Austria | 604 | 3,192 | 8,152 | 12,542 | 1,461 | 4,381 |
| 12 | United Kingdom | 4,323 | 5,767 | 7,991 | 12,294 | 1,305 | 2,604 |
| 13 | Latvia | 0 | 636 | 5,019 | 7,721 | 1,027 | 2,512 |
| 14 | Bulgaria | 582 | 1,395 | 2,106 | 3,240 | 776 | 1,832 |
| 15 | Hungary | 662 | 1,502 | 3,113 | 4,790 | 765 | 1,718 |
| 16 | Slovakia | 63 | 585 | 2,765 | 4,254 | 606 | 2,026 |
| 17 | Lithuania | 0 | 514 | 2,629 | 4,045 | 424 | 1,434 |
| 18 | Slovenia | 0 | 955 | 2,749 | 4,230 | 350 | 1,048 |
| 19 | Estonia | 0 | 0 | 3,496 | 5,378 | 313 | 916 |
| 20 | Denmark | 171 | 543 | 1,051 | 1,616 | 234 | 537 |
| 21 | Greece | 589 | 785 | 1,246 | 1,917 | 207 | 640 |
| 22 | Croatia | 290 | 789 | 1,999 | 3,076 | 188 | 528 |
| 23 | Ireland | 0 | 302 | 1,262 | 1,941 | 159 | 377 |
| 24 | Netherlands | 77 | 305 | 477 | 734 | 25 | 139 |
| 25 | Cyprus | 5 | 7 | 10 | 15 | 3 | 6 |
| | **Total** | **32,693** | **92,110** | **202,585** | **311,669** | **37,421** | **98,724** |

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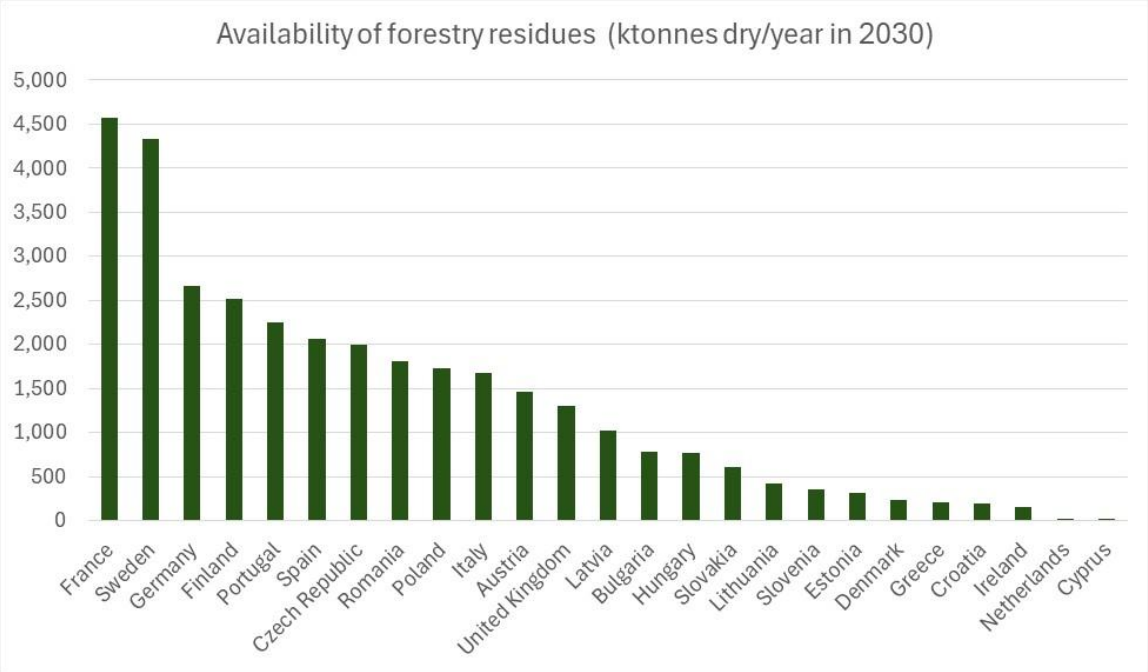



*Figure 28: Availability of forestry residues in 2030 in kt dry biomass (source: WUR, 2024).*

### Other woody biomass

Table 23 shows the expected availability of a number of other woody biomass types in the EU-27 by 2030, based on the study on the outlook for drop in advanced biofuels (WUR 2024). If one or more of the feedstocks are suitable for the selected technologies, more information per member state can be directly obtain from WUR (2024). Non-hazardous post-consumer wood may be of interest but will probably receive considerable competition from other wood processing sectors such as the particle board industry, which would prevail if the cascading principle is followed. Bark is available in large quantities but may be difficult to process.

*Table 23: Other woody biomass types available in large volumes in the EU (in Mt/year in 2030, as technical potential and in low, medium and high mobilization scenarios) (source: WUR, 2024).*

| Woody biomass type | Low | Medium | High | Technical potential |
|---|---|---|---|---|
| **Bark** | 2.7 | 4.1 | 5.4 | 5.4 |
| **Black liquor** | 12.8 | 19.2 | 25.6 | 25.6 |
| **Primary residues from permanent crops (prunings)** | 3.7 | 6.7 | 9.4 | 15.0 |
| **Post consumer wood (hazardous)** | 1.8 | 2.8 | 3.7 | 3.7 |
| **Post consumer wood (non-hazardous)** | 4.5 | 9.0 | 12.0 | 20.4 |
| **Residues from further wood processing** | 3.9 | 7.8 | 11.6 | 15.5 |
| **Stumps** | 0.0 | 5.0 | 5.0 | 69.9 |

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## 5.2 Other lignocellulosic biomass

Table 24 shows the expected availability of a number of other lignocellulosic biomass types in the EU-27 by 2030, based on the study on the outlook for drop in advanced biofuels (WUR, 2024). If one or more of the feedstocks are suitable for the selected technologies, more information per member state can be directly obtain from WUR (2024).

*Table 24: Other biomass types available in large volumes in the EU (in Mt/year in 2030, as technical potential and in low, medium and high mobilization scenarios) (source: WUR, 2024).*

| Name | Low | Medium | High | Technical potential |
|---|---|---|---|---|
| **Lignocellulosic energy crops from unused and abandoned lands: sorghum, miscanthus, switchgrass, giant reed, RCG, cardoon** | 1.3 | 2.5 | 3.9 | 13.3 |
| **Maize cobs** | 1.7 | 3.5 | 5.2 | 6.9 |
| **Straw (cereals)** | 0.0 | 43.4 | 89.9 | 200.8 |
| **Straw (non-cereals)** | 57.8 | 85.6 | 135.3 | 166.4 |

## 5.3 Poultry feathers

The Horizon 2020 project UNLOCK analysed the total theoretical feather availability in 2020 and the actual feather supply in 2010 to 2020 for the EU and five main producing countries: Poland, Italy, France, Spain and Germany, as visible in Table 25 (UNLOCK, 2021).

*Table 25: Total feather availability and feather supply for EU and five MS (source: UNLOCK project).*

| Country | Total feather availability in 2020 (kt) | | | | Feather supply in 2010-2020 (kt) | Remaining collection potential (kt) |
|---|---|---|---|---|---|---|
| | Chickens | Ducks | Turkey | Total | Total | Total |
| **DE** | 59 | 2 | 28 | 89 | 84 | 5 |
| **ES** | 91 | 1 | 13 | 106 | 90 | 16 |
| **FR** | 60 | 16 | 19 | 95 | 96 | -1 |
| **IT** | 85 | 0 | 26 | 111 | 105 | 6 |
| **PL** | 119 | 5 | 24 | 148 | 110 | 38 |
| **Other** | 144 | 3 | 2 | 149 | 137 | 13 |
| **EU** | **558** | **28** | **112** | **699** | **621** | **78** |

### 5.3.1 Availability at site level

The availability of feathers at site level is defined by the number of birds per slaughterhouse, taking into account a killing-out rate (chicken: 75%; turkey: 80%), the liveweight of the livestock (chicken: 2.16 kg; turkey: 11.93 kg), and the percentage of feathers on the liveweight (chicken: 4%; turkey: 5%) (UNLOCK, 2021). This results in an estimated average of feathers per size of farm, see Table 26.

*Table 26: Calculated average amount of chicken and turkey feathers per size of farm, based on assumptions and data from UNLOCK (2021).*

| Chicken feathers (tonnes/farm) | | | | |
|---|---|---|---|---|
| < 5,000 chickens | 5,000 – 9,999 chickens | 10,000 – 29,999 chickens | 30,000 – 49,999 chickens | > 50,000 chickens |
| 0.5 | 1.0 | 2.6 | 5.2 | 7.8 |
| **Turkey feathers (tonnes/farm)** | | | | |
| 1 – 99 turkeys | 100 – 999 turkeys | 1,000 – 9,999 turkeys | > 10,000 turkeys | |
| 0.02 | 0.3 | 2.7 | 9.0 | |

### 5.3.2 Current consumption

As shown in Table 25, in the EU, an average of 621 Mt feathers is available annually. According to the research done by the UNLOCK project, there is a substantial demand for feathers, mostly for processing into animal feed and fertilisers via anaerobic digestion (UNLOCK, 2022). Whereas processing feather waste into animal feed is restricted due to disease transmission concerns, anaerobic digestion has less regulatory restrictions (El Salamony et al., 2024).

## 5.4 Potato processing residues

The (semi-)solid residues come from potato processing and product manufacturing and include residues like peels, rejected potatoes, pulp or starch residues. The fresh potato production (potato harvest) per MS can be retrieved from Eurostat *apro_cpnh1*, R1000 (Eurostat, 2025i). According to Bharathi et al. (2025), approximately 50% of global potato production is consumed fresh, and the remaining 50% is processed. Chauhan et al. (2023) also share this estimation, by reporting that between 50 to 60% of the potato crop is processed in North America and certain European nations. According to Chauhan et al. (2023) and Imperial College London (2021), the potato processing industry produces respectively, between 12 and 20% and 15% of the potato input as waste. Therefore, the potato processing residues are calculated by assuming 50-60% of the potato production goes to processing plants, of which 12-20% is waste. The results of this estimation are shown in Table 27. For the **EU, a total potato processing residue availability potential between 3,047 and 6,094 kt** is calculated.

It should be noted that a significant part of the calculated availability is already valorised for animal feed, or further processed for starch recovery or bio-based chemicals and materials (Imperial College London, 2021)

*Table 27: Estimated potato processing residue potential in 2024 (source: Eurostat, 2025i).*

| Country | Potatoes processed (kt) | | Potato processing residues (kt) | |
|---|---|---|---|---|
| | Midpoint | Range | Midpoint | Range |
| **AT** | 382 | 347 - 416 | 62 | 42 - 83 |
| **BE** | 2,188 | 1,989 - 2,387 | 358 | 239 - 477 |
| **BG** | 63 | 57 - 68 | 10 | 7 - 14 |
| **CY** | 45 | 41 - 49 | 7 | 5 - 10 |
| **CZ** | 361 | 328 - 393 | 59 | 39 - 79 |
| **DE** | 6,987 | 6,352 - 7,622 | 1,143 | 762 - 1,524 |

| | | | | |
|---|---|---|---|---|
| **DK** | 1,649 | 1,499 - 1,799 | 270 | 180 - 360 |
| **EE** | 38 | 35 - 42 | 6 | 4 - 8 |
| **EL** | 183 | 166 - 200 | 30 | 20 - 40 |
| **ES** | 1,084 | 986 - 1,183 | 177 | 118 - 237 |
| **FI** | 304 | 277 - 332 | 50 | 33 - 66 |
| **FR** | 5,081 | 4,619 - 5,542 | 831 | 554 - 1,108 |
| **HR** | 74 | 67 - 80 | 12 | 8 - 16 |
| **HU** | 129 | 117 - 141 | 21 | 14 - 28 |
| **IE** | 203 | 184 - 221 | 33 | 22 - 44 |
| **IT** | 777 | 706 - 848 | 127 | 85 - 170 |
| **LT** | 146 | 133 - 159 | 24 | 16 - 32 |
| **LU** | 10 | 9 - 11 | 2 | 1 - 2 |
| **LV** | 72 | 65 - 78 | 12 | 8 - 16 |
| **MT** | 4 | 3 - 4 | 1 | 0 - 1 |
| **NL** | 3,502 | 3,183 - 3,820 | 573 | 382 - 764 |
| **PL** | 3,256 | 2,960 - 3,552 | 533 | 355 - 710 |
| **PT** | 197 | 179 - 215 | 32 | 21 - 43 |
| **RO** | 579 | 527 - 632 | 95 | 63 - 126 |
| **SE** | 484 | 440 - 528 | 79 | 53 - 106 |
| **SI** | 41 | 37 - 45 | 7 | 4 - 9 |
| **SK** | 94 | 85 - 102 | 15 | 10 - 20 |
| **EU** | **27,929** | **25,390 - 30,468** | **4,570** | **3,047 - 6,094** |

As visible, also from Figure 29, the potato processing residue potential could be highest in Germany, France and the Netherlands. For the Netherlands, the quantity of processed potato products (meaning: processed minus waste), corresponds to the sector reports (VAVI, 2019; West et al., 2021).

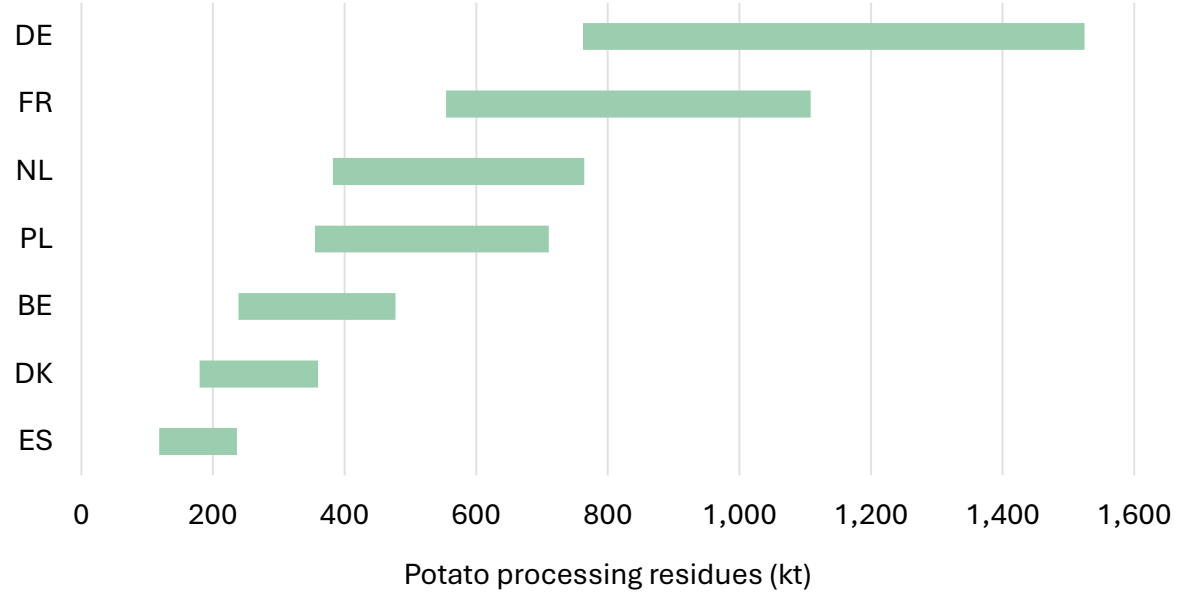



*Figure 29: Estimation of the potato processing residue potential in 2024 (kt).*

# 6 Conclusions, outlook and recommendations

## Conclusions

This report provides an assessment of the technical availability of secondary raw material streams that are relevant for nutrient recovery technologies across the EU27. European statistics, literature sources and expert assumptions have been combined and if possible, a distinguishment between the theoretical generation and practically collectable quantities of feedstocks has been made. A further translation into the availability per site (e.g., farm, treatment plant) has been made where possible. It should be noted that some residues are already valorised and the total availability as calculated in this report is therefore unlikely to fully be available for bio-based fertiliser production. For manure, Köninger et al. (2021) report that more than 90% of the produced manure is directly re-applied on soils as fertiliser. This directly affects the digestate potential from manure since most manure is applied to land without prior digestion, the estimated potential here reflects the assumed 10% AD share rather than an observed volume. Regarding bio-waste, Eurostat reports 43.5 Mt composted and digested in 2022 (ECN reports 38.4 Mt), which mostly comes from the 43-47 Mt separately collected bio-waste, indicating that the separately collected fraction is therefore already largely treated through composting and AD. The underutilised fraction is mainly still in the mixed municipal waste, which makes up about 31-69 Mt. Increased application of separate collection in countries like Germany, France, Poland, Italy and Spain, can make more organic waste available for composting due to their largest absolute quantities of bio-waste remaining in mixed municipal waste. Half of the dry matter sewage sludge from urban wastewater treatment plants already goes to agronomic applications (agriculture and composting and other applications). Additionally, for industrial effluent sludges, more than half is already treated via recovery by recycling and energy recovery, meaning that the majority is already in a recovery route rather than in disposal. Another clear case of an already valorised stream are the poultry feathers, of which 621 kt of the 699 kt available feathers are already supplied to existing uses, as animal feed and AD, leaving only a small remaining collection potential. The technical potential for stemwood and forest residues considers only technical constraints on extraction, and the competing uses are not considered. Actual availability for nutrient recovery is therefore considerably lower than the presented technical potential.

The results confirm that manure is the most available feedstock in mass that has been evaluated in the EU. Based on assumptions and literature, an estimation of the actual availability due to housing systems and current agricultural applications, has been made. Bio-waste represents a second major feedstock category, but its availability depends strongly on the collection systems which also differ per MS. While significant quantities of food and garden waste are generated yearly, quite a large part still ends up in the mixed municipal waste streams and are therefore not treated effectively. Sewage sludge from urban and other wastewater treatment plant is also a feedstock category that is relevant through the EU. The analysis does show that the sludge disposal pathways differ significantly across MS. Lignocellulosic biomass is abundant throughout the EU, especially stemwood.

Overall, although estimation of exact volumes can be challenging, it can be concluded that most feedstocks relevant to produce bio-based fertilisers are abundant and available in each EU Member State. Current collection and application practices, however, differ and determine the possible recovery of bio-based fertilisers.

Additionally, a relatively small number of large farms or treatment facilities account for a large share of the technically available feedstock.

## Outlook

The availability figures presented in this report describe the situation as reported in most recent statistics and references, generally 2022-2024. Some EU legislations can change parts of the presented data within the next years. The revised Urban Wastewater Treatment Directive (EU) 2024/3019 states that mandatory treatments is required from 1,000 p.e. onwards, and requires nutrient removal also in smaller agglomerations that are located in sensitive areas (European Parliament and Council, 2024). Tertiary treatment, the removal of nitrogen and phosphorus, will have to be applied in increasing amounts, from 30% by 2033, 70% by 2036 and in all cases by 2030, for installations with 150,000 p.e. capacities (European

Commission, n.a.). Sludge volumes will therefore increase, because more facilities will be connected and because more intensive nutrient removal will generate additional sludge. The revision also includes a minimum combined reuse and recycling rate for phosphorus from sludge and from urban wastewater, recognising phosphorus as a critical substance to be recovered (European Parliament and Council, 2024).

Directive (EU) 2018/850 prohibits the landfilling of biodegradable waste that has been separately collected for recycling as of 2030 (European Parliament and Council, 2018). Combining this with the obligation to collect bio-waste separately under the Waste Framework Directive, indicates that less bio-waste will end up in the residual waste stream. As described above, 31-69 Mt of bio-waste is currently in the mixed municipal waste and accounts thus for a large, underutilised feedstock stream. The obligations in the Directive (EU) 2018/850 will in all likelihood result in an increase in available feedstock, not considering a decrease or increase in waste generation, but more on the captured waste that is already generated.

## Recommendations

Based on this assessment, some recommendations have been drafted for future analysis of secondary raw material availability.

A **distinguishment between generation and actual availability** (e.g., collection of waste) is highly relevant since using generation data alone can result in an overestimation of the realistic nutrient recovery potential. However, data is generally lacking on scenario analysis for collection. Amongst others, is the unknown share of collected food waste. The food waste generated is monitored by the EU, but how much of that food waste is collected, and can therefore be properly treated, is unknown and can only be estimated by assumptions.

The exact volumes of solely manure currently being used in AD, as well as the quantity of digestate are difficult to assess, because available statistics and official national data on biogas production in several countries do not distinguish the feedstock of the biogas plant (manure, agricultural residues). It is recommended that in future statistical reporting attention is paid to the feedstock used, which would simultaneously provide more insight in the availability of manure digestate.

Throughout this study, statistics, sector reports and scientific literature often use different definitions of waste streams. A more uniform system in which all studies use the same (e.g., by using EU definitions) **definitions**, would make comparison studies more accurate.

The current report provides an overview of feedstock availability at EU and Member State level, but there is a lack of insight in local and regional availability of feedstock at the level of collection points. It is recommended to further develop tools and methods to assess the availability of feedstock at site level, based on the needs of industrial stakeholder and policy makers.

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# 8 Annex

## a) Selection of case studies

*Table 28: Selected case studies within FertiCovery.*

| # | Technology type | Main feedstock group | Specifics |
|---|---|---|---|
| 1 | Anaerobic digestion | Bio-waste | Bio-waste |
| 2 | Anaerobic digestion | Bio-waste | Bio-waste |
| 3 | Anaerobic digestion | Bio-waste | Bio-waste |
| 4 | Anaerobic digestion | Manure/digestate | Pig manure |
| 5 | Anaerobic digestion | Bio-waste | Food industry by-products; municipal bio-waste, garden waste |
| 6 | Anaerobic digestion | Bio-waste | Food waste |
| 7 | Composting | Bio-waste | Bio-waste, including food and garden waste |
| 8 | Composting | Bio-waste | Garden waste |
| 9 | Composting | Bio-waste | Bio-waste |
| 10 | Composting | Bio-waste | Herbaceous parts of branches, leaves, grass from gardens |
| 11 | Fermentation | Others | Potato residues |
| 12 | Hydrolysis | Sludges | Solids from WWTP |
| 13 | Hydrolysis | Sludges | Sewage sludge |
| 14 | Hydrolysis | Others | Poultry feathers |
| 15 | Hydrolysis | Manure/digestate | Digestate from AD |
| 16 | Others | Manure/digestate | Animal manure, liquid fraction digestate |
| 17 | Physical | Sludges | Municipal and industrial wastewater, digested sludge |
| 18 | Physical | Sludges | Sludge dewatering liquor, WWTP internal recycle streams |
| 19 | Physical | Manure/digestate | Animal manure, sludge from industrial WWTP and other bio-wastes |
| 20 | Physical | Manure/digestate | Liquid fraction of digestate |
| 21 | Physicochemical | Manure/digestate | Liquid fraction of manure or digestate |
| 22 | Physicochemical | Manure/digestate | Pig manure and digestate |
| 23 | Thermochemical | Lignocellulosic biomass | Biomass residues, other woody biomass |
| 24 | Thermochemical | Lignocellulosic biomass | Agricultural and forestry residues |
| 25 | Thermochemical | Bio-waste | Herbaceous parts of branches, leaves, grass from gardens |

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## b) Manure production

*Table 29: Number of livestock and manure production in 2024 (source: Eurostat, 2025a; Köninger et al, 2021; EBA).*

| Country | Pigs (million heads) | Pigs – Manure production (Mt) | | Cattle (million heads) | Cattle – Manure production (Mt) | | Poultry (million heads) | Poultry – Manure production (Mt) | |
|---|---|---|---|---|---|---|---|---|---|
| | Eurostat | JRC | EBA | Eurostat | JRC | EBA | Eurostat | JRC | EBA |
| AT | 2.5 | 3.0 | 9.3 | 1.8 | 22.4 | 33.2 | 18.8 | 1.8 | 1.2 |
| BE | 5.4 | 6.5 | 19.6 | 2.2 | 26.5 | 39.3 | 53.9 | 5.1 | 3.3 |
| BG | 0.7 | 0.8 | 2.6 | 0.6 | 6.9 | 10.2 | 18.2 | 1.7 | 1.1 |
| CY | 0.3 | 0.4 | 1.1 | 0.1 | 1.0 | 1.5 | 4.7 | 0.4 | 0.3 |
| CZ | 1.4 | 1.7 | 5.2 | 1.4 | 17.2 | 25.5 | 23.9 | 2.3 | 1.5 |
| DE | 21.3 | 25.6 | 77.8 | 10.5 | 128.7 | 191.0 | 167.3 | 15.9 | 10.4 |
| DK | 11.6 | 13.9 | 42.3 | 1.4 | 17.4 | 25.8 | 22.0 | 2.1 | 1.4 |
| EE | 0.3 | 0.3 | 1.0 | 0.2 | 2.9 | 4.2 | 1.9 | 0.2 | 0.1 |
| EL | 0.8 | 0.9 | 2.9 | 0.6 | 7.3 | 10.9 | 29.9 | 2.8 | 1.9 |
| ES | 34.6 | 41.5 | 126.2 | 6.2 | 75.9 | 112.8 | 231.2 | 22.0 | 14.4 |
| FI | 1.0 | 1.2 | 3.6 | 0.8 | 9.4 | 14.0 | 13.3 | 1.3 | 0.8 |
| FR | 11.7 | 14.1 | 42.8 | 16.5 | 202.7 | 300.9 | 285.4 | 27.1 | 17.7 |
| HR | 0.9 | 1.0 | 3.2 | 0.4 | 5.2 | 7.7 | 10.2 | 1.0 | 0.6 |
| HU | 2.8 | 3.4 | 10.2 | 0.9 | 10.7 | 15.9 | 38.3 | 3.6 | 2.4 |
| IE | 1.5 | 1.8 | 5.4 | 6.3 | 77.6 | 115.2 | 16.5 | 1.6 | 1.0 |
| IT | 7.8 | 9.4 | 28.6 | 5.8 | 70.9 | 105.3 | 173.2 | 16.5 | 10.8 |
| LT | 0.5 | 0.6 | 1.8 | 0.6 | 7.4 | 11.0 | 11.3 | 1.1 | 0.7 |
| LU | 0.1 | 0.1 | 0.2 | 0.2 | 2.2 | 3.3 | 0.2 | 0.0 | 0.0 |
| LV | 0.3 | 0.4 | 1.1 | 0.4 | 4.3 | 6.4 | 5.7 | 0.5 | 0.4 |
| MT | 0.0 | 0.0 | 0.1 | 0.0 | 0.2 | 0.3 | 0.8 | 0.1 | 0.0 |
| NL | 10.2 | 12.2 | 37.2 | 3.6 | 43.8 | 65.1 | 94.2 | 9.0 | 5.9 |
| PL | 9.1 | 10.9 | 33.2 | 6.2 | 76.1 | 113.1 | 227.8 | 21.6 | 14.1 |
| PT | 2.2 | 2.6 | 8.0 | 1.5 | 18.3 | 27.2 | 47.8 | 4.5 | 3.0 |

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|---|---|---|---|---|---|---|---|---|---|
| **RO** | 3.3 | 3.9 | 11.9 | 1.8 | 22.3 | 33.0 | 51.8 | 4.9 | 3.2 |
| **SE** | 1.3 | 1.6 | 4.9 | 1.3 | 16.4 | 24.4 | 25.9 | 2.5 | 1.6 |
| **SI** | 0.2 | 0.3 | 0.8 | 0.5 | 5.6 | 8.3 | 7.0 | 0.7 | 0.4 |
| **SK** | 0.4 | 0.5 | 1.5 | 0.4 | 5.1 | 7.6 | 10.1 | 1.0 | 0.6 |
| **EU** | **132.1** | **158.5** | **482.5** | **71.9** | **884.3** | **1,313.0** | **1,591.4** | **151.2** | **98.8** |

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## c) Manure collection potentials

### Organic manure collection potential

Using the formulas from section 2.1.1 and the estimated collection factors, reports the calculation results for the organic manure collection potential per MS in 2023. With a total EU potential between 35 and 53 Mt[6].

*Table 30: Organic manure collection potential in 2023 (based on Eurostat, 2025c; DK from 2022).*

| Country | Pigs - Organic manure collection potential (kt) | | Cattle - Organic manure collection potential (kt) | | Poultry - Organic manure collection potential (kt) | | Organic manure collection potential total (Mt) | |
|---|---|---|---|---|---|---|---|---|
| | Midpoint | Range | Midpoint | Range | Midpoint | Range | Midpoint | Range |
| **AT** | **124** | 61–187 | **3,158** | 2,542–3,774 | **172** | 136–208 | **3** | **3–4** |
| **BE** | **50** | 24–75 | **825** | 664–986 | **281** | 222–340 | **1** | **1–1** |
| **BG** | **0** | 0–0 | **72** | 58–86 | **0** | 0–0 | **0** | **0–0** |
| **CY** | **0** | 0–0 | **4** | 3–4 | **1** | 1–1 | **0** | **0–0** |
| **CZ** | **3** | 1–4 | **2,080** | 1,675–2,486 | **3** | 2–3 | **2** | **2–2** |
| **DE** | **296** | 147–446 | **7,253** | 5,838–8,668 | **471** | 372–569 | **8** | **6–10** |
| **DK** | **277** | 137–417 | **1,744** | 1,404–2,084 | **216** | 171–262 | **2** | **2–3** |
| **EE** | **1** | 0–1 | **323** | 260–386 | **2** | 2–3 | **0** | **0–0** |
| **EL** | **0** | 0–0 | **0** | 0–0 | **17** | 13–20 | **0** | **0–0** |
| **ES** | **36** | 18–54 | **2,417** | 1,946–2,889 | **108** | 85–131 | **3** | **2–3** |
| **FI** | **4** | 2–6 | **637** | 513–761 | **19** | 15–23 | **1** | **1–1** |
| **FR** | **441** | 218–664 | **9,403** | 7,569–11,238 | **1,311** | 1,036–1,586 | **11** | **9–13** |
| **HR** | **1** | 0–1 | **290** | 234–347 | **0** | 0–0 | **0** | **0–0** |
| **HU** | **5** | 2–7 | **172** | 139–206 | **5** | 4–6 | **0** | **0–0** |
| **IE** | **1** | 0–1 | **613** | 493–732 | **11** | 9–13 | **1** | **1–1** |
| **IT** | **66** | 33–100 | **3,586** | 2,886–4,286 | **240** | 190–290 | **4** | **3–5** |
| **LT** | **0** | 0–0 | **466** | 375–557 | **1** | 1–1 | **0** | **0–1** |

[6] EL has no data available on organic pig and cattle.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **LU** | **4** | 2–6 | **56** | 45–67 | **2** | 2–3 | **0** | **0–0** |
| **LV** | **1** | 1–2 | **600** | 483–717 | **3** | 2–3 | **1** | **0–1** |
| **MT** | **0** | 0–0 | **0** | 0–0 | **0** | 0–0 | **0** | **0–0** |
| **NL** | **142** | 70–214 | **645** | 519–771 | **214** | 169–259 | **1** | **1–1** |
| **PL** | **6** | 3–9 | **223** | 180–267 | **38** | 30–46 | **0** | **0–0** |
| **PT** | **7** | 3–10 | **1,560** | 1,255–1,864 | **3** | 2–4 | **2** | **1–2** |
| **RO** | **0** | 0–0 | **209** | 168–250 | **9** | 7–11 | **0** | **0–0** |
| **SE** | **28** | 14–43 | **2,211** | 1,779–2,642 | **75** | 60–91 | **2** | **2–3** |
| **SI** | **3** | 2–5 | **301** | 243–360 | **5** | 4–6 | **0** | **0–0** |
| **SK** | **1** | 1–2 | **597** | 480–713 | **0** | 0–0 | **1** | **0–1** |
| **EU** | **1,498** | **741–2255** | **39,446** | **31,750–47,141** | **3,208** | **2,536–3,880** | **44** | **35–53** |

### Conventional manure collection potential

Using the formulas from section 2.1.1 and the estimated collection factors, reports the calculation results for the conventional manure collection potential per MS in 2023. With a total EU potential between 818 and 1,441 Mt.

*Table 31: Conventional manure collection potential in 2023 (based on Eurostat, 2025c; DK from 2022).*

| Country | Pigs - Conventional manure collection potential (kt) | | Cattle - Conventional manure collection potential (kt) | | Poultry - Conventional manure collection potential (kt) | | Conventional manure collection potential total (Mt) | |
|---|---|---|---|---|---|---|---|---|
| | Midpoint | Range | Midpoint | Range | Midpoint | Range | Midpoint | Range |
| **AT** | **5** | 3–8 | **15** | 12–18 | **1** | 1–1 | **22** | **16–27** |
| **BE** | **12** | 6–18 | **23** | 18–27 | **3** | 3–4 | **38** | **27–49** |
| **BG** | **2** | 1–2 | **6** | 5–7 | **1** | 1–2 | **9** | **7–11** |
| **CY** | **1** | 0–1 | **1** | 1–1 | **0** | 0–0 | **2** | **1–2** |
| **CZ** | **3** | 1–4 | **12** | 9–14 | **2** | 1–2 | **16** | **12–21** |
| **DE** | **46** | 23–69 | **106** | 85–126 | **11** | 9–14 | **163** | **117–209** |
| **DK** | **24** | 12–37 | **13** | 10–15 | **1** | 1–2 | **39** | **23–54** |

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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **EE** | **1** | 0–1 | **2** | 2–3 | **0** | 0–0 | **3** | **2–4** |
| **EL** | **2** | 1–3 | **7** | 6–8 | **2** | 2–3 | **11** | **8–13** |
| **ES** | **74** | 36–111 | **64** | 51–76 | **16** | 13–20 | **154** | **101–207** |
| **FI** | **2** | 1–3 | **8** | 6–9 | **1** | 1–1 | **11** | **8–13** |
| **FR** | **25** | 12–38 | **167** | 134–199 | **18** | 15–22 | **210** | **161–259** |
| **HR** | **2** | 1–3 | **4** | 3–5 | **1** | 1–1 | **7** | **5–8** |
| **HU** | **6** | 3–9 | **9** | 7–11 | **3** | 2–3 | **17** | **12–23** |
| **IE** | **3** | 2–5 | **69** | 55–82 | **1** | 1–1 | **73** | **58–88** |
| **IT** | **20** | 10–30 | **59** | 48–71 | **12** | 9–14 | **91** | **67–115** |
| **LT** | **1** | 1–2 | **6** | 5–7 | **1** | 1–1 | **8** | **6–10** |
| **LU** | **0** | 0–0 | **2** | 2–2 | **0** | 0–0 | **2** | **2–2** |
| **LV** | **1** | 0–1 | **3** | 2–4 | **0** | 0–0 | **4** | **3–5** |
| **MT** | **0** | 0–0 | **0** | 0–0 | **0** | 0–0 | **0** | **0–0** |
| **NL** | **22** | 11–34 | **39** | 31–47 | **6** | 5–8 | **68** | **48–88** |
| **PL** | **21** | 11–32 | **67** | 54–80 | **16** | 13–19 | **104** | **77–131** |
| **PT** | **5** | 2–7 | **14** | 11–17 | **3** | 3–4 | **22** | **16–28** |
| **RO** | **7** | 3–10 | **19** | 15–23 | **4** | 3–4 | **30** | **22–38** |
| **SE** | **3** | 1–4 | **12** | 9–14 | **2** | 1–2 | **16** | **12–20** |
| **SI** | **0** | 0–1 | **4** | 4–5 | **0** | 0–1 | **5** | **4–7** |
| **SK** | **1** | 0–1 | **4** | 3–4 | **1** | 1–1 | **5** | **4–7** |
| **EU** | **287** | **142–433** | **734** | **591–877** | **108** | **86–131** | **1,130** | **818–1,441** |

### Total manure collection potential

Adding the previous two tables of conventional manure collection potential and organic manure collection potential, gives the total manure collection potential per MS in Table 34, and EU wide between 35.8 and 54.7 Mt.

*Table 32: Total manure collection potential in 2023.*

| Country | Pigs - Total manure collection potential (kt) | Cattle - Total manure collection potential (kt) | Poultry - Total manure collection potential (kt) | Total manure collection potential (kt) |
|---|---|---|---|---|

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| | Midpoint | Range | Midpoint | Range | Midpoint | Range | Midpoint | Range |
|---|---|---|---|---|---|---|---|---|
| **AT** | 5 | 3–8 | 18 | 15–22 | 1 | 1–2 | 25 | **18-32** |
| **BE** | 12 | 6–18 | 24 | 19–28 | 4 | 3–5 | 39 | **28-50** |
| **BG** | 2 | 1–2 | 6 | 5–7 | 1 | 1–2 | 9 | **7-11** |
| **CY** | 1 | 0–1 | 1 | 1–1 | 0 | 0–0 | 2 | **1-2** |
| **CZ** | 3 | 1–4 | 14 | 11–17 | 2 | 1–2 | 18 | **14-23** |
| **DE** | 46 | 23–69 | 113 | 91–135 | 12 | 9–14 | 171 | **123-219** |
| **DK** | 25 | 12–37 | 15 | 12–18 | 1 | 1–2 | 41 | **25-56** |
| **EE** | 1 | 0–1 | 2 | 2–3 | 0 | 0–0 | 3 | **2-4** |
| **EL** | 2 | 1–3 | 7 | 6–8 | 2 | 2–3 | 11 | **8-13** |
| **ES** | 74 | 36–111 | 66 | 53–79 | 16 | 13–20 | 156 | **103-210** |
| **FI** | 2 | 1–3 | 8 | 7–10 | 1 | 1–1 | 11 | **8-14** |
| **FR** | 25 | 13–38 | 176 | 142–210 | 20 | 16–24 | 221 | **170-273** |
| **HR** | 2 | 1–3 | 4 | 3–5 | 1 | 1–1 | 7 | **5-9** |
| **HU** | 6 | 3–9 | 9 | 7–11 | 3 | 2–3 | 18 | **12-23** |
| **IE** | 3 | 2–5 | 70 | 56–83 | 1 | 1–1 | 74 | **58-89** |
| **IT** | 20 | 10–30 | 63 | 50–75 | 12 | 10–15 | 95 | **70-120** |
| **LT** | 1 | 1–2 | 6 | 5–8 | 1 | 1–1 | 8 | **6-10** |
| **LU** | 0 | 0–0 | 2 | 2–2 | 0 | 0–0 | 2 | **2-3** |
| **LV** | 1 | 0–1 | 4 | 3–4 | 0 | 0–0 | 5 | **4-6** |
| **MT** | 0 | 0–0 | 0 | 0–0 | 0 | 0–0 | 0 | **0-0** |
| **NL** | 23 | 11–34 | 40 | 32–47 | 7 | 5–8 | 69 | **48-89** |
| **PL** | 21 | 11–32 | 67 | 54–80 | 16 | 13–19 | 104 | **77-132** |
| **PT** | 5 | 2–7 | 16 | 13–19 | 3 | 3–4 | 24 | **18-30** |
| **RO** | 7 | 3–10 | 19 | 16–23 | 4 | 3–4 | 30 | **22-38** |
| **SE** | 3 | 1–4 | 14 | 11–16 | 2 | 1–2 | 18 | **14-23** |
| **SI** | 0 | 0–1 | 5 | 4–6 | 0 | 0–1 | 6 | **4-7** |
| **SK** | 1 | 0–1 | 4 | 4–5 | 1 | 1–1 | 6 | **5-7** |
| **EU** | **289** | **143–435** | **773** | **622–924** | **112** | **88–135** | **1,174** | **853-1,494** |

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## d) Livestock per holding

### Pig – A3100 (2023)

*Table 33: Number of pigs (HD in thousand heads) and holdings (HLD in thousand holdings) per size of farm (Eurostat, 2025d). No values means no available data.*

| Country | 0-5 ha | | 5-29 ha | | 30-99 ha | | >100 ha | |
|---|---|---|---|---|---|---|---|---|
| | HD | HLD | HD | HLD | HD | HLD | HD | HLD |
| AT | 21 | 1.4 | 655 | 12.6 | 1,709 | 7.8 | 167 | 0.4 |
| BE | | | | | | | | |
| BG | 30 | 1.0 | 12 | 0.8 | 53 | 0.3 | 148 | 0.1 |
| CY | 137 | 0.1 | | 0.1 | | 0.0 | | 0.0 |
| CZ | 310 | 0.5 | 294 | 1.0 | 39 | 0.5 | 574 | 0.5 |
| DE | 141 | 0.4 | 1,117 | 7.8 | 7,731 | 11.1 | 8,291 | 5.9 |
| DK | | | | | | | | |
| EE | | 0.0 | | 0.0 | | 0.0 | 36 | 0.0 |
| EL | 220 | 1.8 | 104 | 2.1 | 37 | 0.5 | 2 | 0.0 |
| ES | 2,196 | 4.7 | 5,061 | 9.6 | 4,640 | 6.2 | 4,935 | 5.4 |
| FI | | | | | | | | |
| FR | 166 | 1.0 | 599 | 2.1 | 3,968 | 5.4 | 5,031 | 4.6 |
| HR | 157 | 15.2 | 255 | 12.2 | 146 | 1.5 | 140 | 0.2 |
| HU | 58 | 6.7 | 270 | 6.5 | 251 | 1.9 | 1,352 | 0.8 |
| IE | | | | | | | | |
| IT | | | | | | | | |
| LT | | 1.0 | | 2.3 | | 0.5 | 71 | 0.1 |
| LU | | 0.0 | | 0.0 | 26 | 0.0 | | 0.0 |
| LV | | | | | | | | |
| MT | 19 | 0.0 | 5 | 0.0 | | | | |
| NL | 1,897 | 0.6 | 4,298 | 1.4 | 2,289 | 0.8 | | 0.1 |
| PL | 283 | 5.6 | 2,959 | 35.9 | 2,760 | 7.3 | 2,902 | 0.9 |
| PT | 235 | 15.0 | 404 | 5.9 | 178 | 1.2 | 837 | 0.5 |
| RO | 850 | 282.7 | 354 | 90.6 | 50 | 7.6 | 631 | 1.1 |
| SE | 17 | 0.1 | 35 | 0.4 | 116 | 0.2 | 811 | 0.4 |
| SI | | | | | | | | |
| SK | 12 | 0.8 | 8 | 0.8 | 27 | 0.2 | 256 | 0.2 |
| **EU** | **6,747** | **339** | **16,430** | **192** | **24,019** | **53** | **26,185** | **21** |

*Table 34: Average number of pigs per holding and the average tonnes of manure per holding in 2023 (calculated from Eurostat (2025d) and Köninger et al. (2021; no values means not available data).*

| Country | Average number of cattle per holding | | | | Average tonnes manure per holding per year | | | |
|---|---|---|---|---|---|---|---|---|
| | 0-5 ha | 5-29 ha | 30-99 ha | >100 ha | 0-5 ha | 5-29 ha | 30-99 ha | >100 ha |
| AT | 15 | 52 | 220 | 398 | 18 | 63 | 264 | 478 |
| BE | | | | | | | | |
| BG | 31 | 16 | 159 | 1,232 | 38 | 19 | 191 | 1,479 |
| CY | 1,950 | | | | 2,340 | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **CZ** | 673 | 285 | 80 | 1,125 | 808 | 342 | 96 | 1,350 |
| **DE** | 381 | 143 | 694 | 1,412 | 457 | 172 | 833 | 1,695 |
| **DK** | | | | | | | | |
| **EE** | | | | 1,808 | | | | 2,169 |
| **EL** | 121 | 50 | 77 | 61 | 145 | 60 | 92 | 73 |
| **ES** | 463 | 529 | 747 | 922 | 556 | 635 | 897 | 1,107 |
| **FI** | | | | | | | | |
| **FR** | 171 | 288 | 729 | 1,084 | 205 | 346 | 875 | 1,301 |
| **HR** | 10 | 21 | 97 | 637 | 12 | 25 | 117 | 765 |
| **HU** | 9 | 42 | 136 | 1,690 | 10 | 50 | 163 | 2,028 |
| **IE** | | | | | | | | |
| **IT** | | | | | | | | |
| **LT** | | | | 549 | | | | 658 |
| **LU** | | | 865 | | | | 1,038 | |
| **LV** | | | | | | | | |
| **MT** | 472 | 998 | | | 567 | 1,198 | | |
| **NL** | 2,964 | 3,184 | 3,052 | | 3,557 | 3,820 | 3,663 | |
| **PL** | 51 | 82 | 376 | 3,224 | 61 | 99 | 451 | 3,869 |
| **PT** | 16 | 69 | 145 | 1,641 | 19 | 82 | 174 | 1,969 |
| **RO** | 3 | 4 | 7 | 568 | 4 | 5 | 8 | 682 |
| **SE** | 332 | 99 | 505 | 1,886 | 399 | 119 | 606 | 2,263 |
| **SI** | | | | | | | | |
| **SK** | 15 | 10 | 148 | 1,598 | 18 | 12 | 178 | 1,918 |
| **EU** | **452** | **367** | **502** | **1,240** | **542** | **440** | **603** | **1,488** |

### Cattle - A2000 (2023)

*Table 35: Number of cattle (HD in thousand heads) and holdings (HLD in thousand holdings) per size of farm (Eurostat, 2025d). No values means no available data.*

| Country | 0-5 ha | | 5-29 ha | | 30-99 ha | | >100 ha | |
|---|---|---|---|---|---|---|---|---|
| | HD | HLD | HD | HLD | HD | HLD | HD | HLD |
| **AT** | 23 | 3 | 724 | 32 | 1,001 | 15 | 103 | 1 |
| **BE** | | | | | | | | |
| **BG** | 16 | 4 | 82 | 5 | 160 | 4 | 316 | 2 |
| **CY** | 1 | 0.0 | 21 | 0.1 | 28 | 0.1 | 26 | 0.1 |
| **CZ** | 10 | 1 | 53 | 5 | 139 | 4 | 1,205 | 3 |
| **DE** | 37 | 2 | 964 | 37 | 4,118 | 41 | 5,641 | 20 |
| **DK** | | | | | | | | |
| **EE** | 2 | 0.1 | 10 | 1 | 24 | 1 | 202 | 1 |
| **EL** | 138 | 3 | 239 | 5 | 142 | 1 | 30 | 0.1 |
| **ES** | 284 | 11 | 1,299 | 30 | 1,798 | 20 | 2,729 | 16 |
| **FI** | | | | | | | | |
| **FR** | 82 | 6 | 385 | 14 | 4,243 | 51 | 11,913 | 61 |
| **HR** | 18 | 4 | 122 | 9 | 114 | 2 | 142 | 1 |
| **HU** | 26 | 3 | 65 | 4 | 107 | 3 | 646 | 3 |
| **IE** | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **IT** | | | | | | | | |
| **LT** | 20 | 5 | 117 | 15 | 181 | 5 | 331 | 2 |
| **LU** | | 0.0 | 2 | 0.1 | 50 | 0.5 | | 1 |
| **LV** | | | | | | | | |
| **MT** | 8 | 0.1 | 2 | 0.0 | | | | |
| **NL** | 285 | 1 | 710 | 7 | 2,072 | 12 | 702 | 2 |
| **PL** | 220 | 35 | 3,171 | 161 | 2,129 | 34 | 792 | 4 |
| **PT** | 89 | 11 | 342 | 10 | 310 | 4 | 679 | 4 |
| **RO** | 457 | 139 | 603 | 78 | 284 | 9 | 288 | 2 |
| **SE** | 2 | 0.2 | 69 | 4 | 286 | 5 | 1,074 | 5 |
| **SI** | | | | | | | | |
| **SK** | 4 | 1 | 19 | 2 | 26 | 1 | 375 | 1 |
| **EU** | **1,722** | **228** | **9,001** | **418** | **17,213** | **213** | **27,193** | **128** |

*Table 36: Average number of cattle per holding and the average tonnes of manure per holding in 2023 (calculated from Eurostat (2025d) and Köninger et al. (2021); no values means not available data).*

| Country | Average number of cattle per holding | | | | Average tonnes manure per holding per year | | | |
|---|---|---|---|---|---|---|---|---|
| | 0-5 ha | 5-29 ha | 30-99 ha | >100 ha | 0-5 ha | 5-29 ha | 30-99 ha | >100 ha |
| **AT** | 7 | 23 | 66 | 119 | 84 | 282 | 807 | 1,469 |
| **BE** | | | | | | | | |
| **BG** | 4 | 16 | 43 | 142 | 52 | 197 | 529 | 1,741 |
| **CY** | 36 | 164 | 312 | 435 | 443 | 2,013 | 3,842 | 5,353 |
| **CZ** | 10 | 11 | 39 | 360 | 127 | 138 | 476 | 4,423 |
| **DE** | 24 | 26 | 101 | 277 | 297 | 316 | 1,238 | 3,413 |
| **DK** | | | | | | | | |
| **EE** | 16 | 16 | 38 | 269 | 192 | 202 | 463 | 3,313 |
| **EL** | 49 | 52 | 98 | 215 | 599 | 642 | 1,209 | 2,648 |
| **ES** | 25 | 44 | 90 | 168 | 307 | 537 | 1,111 | 2,067 |
| **FI** | | | | | | | | |
| **FR** | 13 | 28 | 83 | 196 | 165 | 343 | 1,020 | 2,406 |
| **HR** | 5 | 14 | 52 | 273 | 62 | 168 | 634 | 3,358 |
| **HU** | 10 | 16 | 40 | 227 | 125 | 199 | 493 | 2,797 |
| **IE** | | | | | | | | |
| **IT** | | | | | | | | |
| **LT** | 4 | 8 | 36 | 168 | 51 | 99 | 438 | 2,065 |
| **LU** | | 20 | 103 | | | 247 | 1,266 | |
| **LV** | | | | | | | | |
| **MT** | 73 | 82 | | | 896 | 1,013 | | |
| **NL** | 221 | 103 | 171 | 375 | 2,720 | 1,262 | 2,100 | 4,614 |
| **PL** | 6 | 20 | 63 | 197 | 78 | 243 | 769 | 2,424 |
| **PT** | 8 | 33 | 77 | 193 | 104 | 408 | 945 | 2,374 |
| **RO** | 3 | 8 | 31 | 140 | 40 | 95 | 385 | 1,722 |
| **SE** | 10 | 16 | 56 | 229 | 117 | 196 | 683 | 2,817 |
| **SI** | | | | | | | | |
| **SK** | 5 | 10 | 31 | 315 | 65 | 129 | 377 | 3,876 |
| **EU** | **28** | **35** | **80** | **239** | **343** | **436** | **989** | **2,938** |

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### Poultry – A5000 (2023)

*Table 37: Number of poultry (HD in thousand heads) and holdings (HLD in thousand holdings) per size of farm (Eurostat, 2025d). No values means no available data.*

| Country | 0-5 ha | | 5-29 ha | | 30-99 ha | | >100 ha | |
|---|---|---|---|---|---|---|---|---|
| | HD | HLD | HD | HLD | HD | HLD | HD | HLD |
| AT | 674 | 4.7 | 8,590 | 28.3 | 6,789 | 11.2 | 930 | 0.6 |
| BE | | | | | | | | |
| BG | 1,215 | 4.7 | 834 | 3.0 | | 1.0 | 2,149 | 0.3 |
| CY | 1,832 | 2.9 | | 0.7 | 4 | 0.1 | | 0.0 |
| CZ | 4,714 | 1.1 | 3,593 | 1.9 | 379 | 0.6 | 5,785 | 0.3 |
| DE | 2,864 | 1.4 | 15,133 | 22.8 | 37,794 | 13.0 | 49,299 | 4.7 |
| DK | | | | | | | | |
| EE | 11 | 0.2 | 28 | 0.8 | 11 | 0.2 | 63 | 0.1 |
| EL | 11,424 | 44.7 | 3,798 | 21.2 | | 2.6 | | 0.1 |
| ES | 32,641 | 6.4 | 40,185 | 4.3 | 22,828 | 1.4 | 13,970 | 0.7 |
| FI | | | | | | | | |
| FR | 12,921 | 2.5 | 36,162 | 4.0 | 88,019 | 6.9 | 82,535 | 5.8 |
| HR | 2,734 | 25.1 | 2,822 | 15.8 | 2,151 | 1.5 | 633 | 0.2 |
| HU | 2,070 | 15.5 | 5,072 | 12.6 | 2,126 | 2.7 | 7,230 | 0.9 |
| IE | | | | | | | | |
| IT | | | | | | | | |
| LT | 2,464 | 9.6 | 2,163 | 14.8 | 1,620 | 2.3 | 2,587 | 0.8 |
| LU | | 0.0 | | 0.1 | 78 | 0.1 | | 0.1 |
| LV | | | | | | | | |
| MT | 386 | 0.0 | 50 | 0.0 | | | | |
| NL | 21,289 | 0.4 | 18,527 | 0.5 | 12,293 | 0.3 | | 0.1 |
| PL | 29,815 | 72.5 | 67,155 | 119.0 | 35,160 | 10.8 | 43,062 | 1.0 |
| PT | 11,195 | 66.3 | 8,416 | 18.0 | 1,868 | 2.3 | 757 | 0.5 |
| RO | 13,098 | 463.0 | 5,044 | 129.5 | 4,444 | 8.9 | 7,729 | 1.3 |
| SE | 371 | 0.5 | 2,087 | 2.6 | 1,855 | 0.7 | 11,459 | 0.5 |
| SI | | | | | | | | |
| SK | | 1.5 | 321 | 1.3 | | 0.1 | 2,754 | 0.1 |
| **EU** | **151,718** | **723** | **219,982** | **401** | **217,419** | **67** | **230,942** | **18** |

*Table 38: Average number of cattle per holding and the average tonnes of manure per holding in 2023 (calculated from Eurostat (2025d) and Köninger et al. (2021); no values means not available data).*

| Country | Average number of cattle per holding | | | | Average tonnes manure per holding per year | | | |
|---|---|---|---|---|---|---|---|---|
| | 0-5 ha | 5-29 ha | 30-99 ha | >100 ha | 0-5 ha | 5-29 ha | 30-99 ha | >100 ha |
| AT | 145 | 304 | 607 | 1,577 | 14 | 29 | 58 | 150 |
| BE | | | | | | | | |
| BG | 261 | 277 | | 8,594 | 25 | 26 | | 816 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **CY** | 640 | | 38 | | 61 | | 4 | |
| **CZ** | 4,405 | 1,872 | 631 | 23,139 | 419 | 178 | 60 | 2,198 |
| **DE** | 2,106 | 664 | 2,912 | 10,489 | 200 | 63 | 277 | 996 |
| **DK** | | | | | | | | |
| **EE** | 69 | 36 | 55 | 903 | 7 | 3 | 5 | 86 |
| **EL** | 255 | 179 | | | 24 | 17 | | |
| **ES** | 5,124 | 9,411 | 15,964 | 19,675 | 487 | 894 | 1,517 | 1,869 |
| **FI** | | | | | | | | |
| **FR** | 5,252 | 9,063 | 12,720 | 14,206 | 499 | 861 | 1,208 | 1,350 |
| **HR** | 109 | 178 | 1,406 | 2,636 | 10 | 17 | 134 | 250 |
| **HU** | 133 | 404 | 790 | 8,215 | 13 | 38 | 75 | 780 |
| **IE** | | | | | | | | |
| **IT** | | | | | | | | |
| **LT** | 256 | 146 | 698 | 3,449 | 24 | 14 | 66 | 328 |
| **LU** | | | 555 | | | | 53 | |
| **LV** | | | | | | | | |
| **MT** | 9,644 | 9,996 | | | 916 | 950 | | |
| **NL** | 49,510 | 40,277 | 42,391 | | 4,703 | 3,826 | 4,027 | |
| **PL** | 411 | 564 | 3,253 | 44,857 | 39 | 54 | 309 | 4,261 |
| **PT** | 169 | 469 | 819 | 1,514 | 16 | 45 | 78 | 144 |
| **RO** | 28 | 39 | 502 | 6,038 | 3 | 4 | 48 | 574 |
| **SE** | 789 | 806 | 2,577 | 24,911 | 75 | 77 | 245 | 2,367 |
| **SI** | | | | | | | | |
| **SK** | | 257 | | 45,895 | | 24 | | 4,360 |
| **EU** | **4,406** | **4,163** | **5,370** | **14,407** | **419** | **396** | **510** | **1,369** |

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## e) Bio-waste

*Table 39: MSW and bio-waste generated and collected (source: BIC, 2024; Eurostat, 2025f).*

| Country | Bio-waste generated in 2022 (kt) (BIC, 2024) | MSW generation in 2022 (kt) (Eurostat, 2025f) | Bio-waste collected in 2022 (kt) (BIC, 2024) | Composted and digested waste (kt) (Eurostat, 2025f) |
|---|---|---|---|---|
| **AT** | 2,308 | 7,261 | 1,562 | **1,478** |
| **BE** | 2,777 | 8,055 | 1,766 | **1,578** |
| **BG** | 1,361 | 3,157 | 68 | **95** |
| **CY** | 107 | 615 | 10 | **10** |
| **CZ** | 2,440 | 5,854 | 768 | **890** |
| **DE** | 18,312 | 50,606 | 12,402 | **11,177** |
| **DK** | 1,603 | 4,478 | 1,186 | **1,070** |
| **EE** | 284 | 503 | 20 | **38** |
| **EL** | 2,008 | 5,420 | 408 | **75** |
| **ES** | 8,870 | 23,030 | 4,980 | **5,045** |
| **FI** | 1,259 | 2,898 | 427 | **428** |
| **FR** | 16,088 | 36,421 | 7,030 | **6,428** |
| **HR** | 869 | 1,844 | 93 | **93** |
| **HU** | 2,364 | 3,911 | 378 | **311** |
| **IE** | 1,189 | 637[7] | 334 | **N/A** |
| **IT** | 10,389 | 28,692 | 7,261 | **6,951** |
| **LT** | 704 | 1,317 | 286 | **288** |
| **LU** | 179 | 471 | 129 | **112** |
| **LV** | 431 | 872 | 69 | **148** |
| **MT** | 67 | 328 | 27 | **0** |
| **NL** | 3,676 | 8,365 | 2,709 | **2,463** |
| **PL** | 9,301 | 13,420 | 1,958 | **1,900** |
| **PT** | 2,526 | 5,323 | 890 | **911** |
| **RO** | 5,161 | 5,767 | 286 | **291** |
| **SE** | 2,362 | 4,139 | 857 | **782** |
| **SI** | 556 | 1,029 | 164 | **165** |
| **SK** | 1,277 | 2,597 | 429 | **430** |
| **EU** | **98,469** | **227,010** | **46,499** | **43,157** |

[7] IE data from 2020.

## f) Food waste

*Table 40: Food waste generation in 2022 per MS per sector (Eurostat, 2025e).*

| Country | Primary production of food (Mt) | Manufacture of food products and beverages (Mt) | Retail and other distribution of food (Mt) | Restaurants and food services (Mt) | Household total activities (Mt) | Total amount of food waste (Mt) |
|---|---|---|---|---|---|---|
| **AT** | 6 | 204 | 83 | 635 | 256 | **1,184** |
| **BE** | 34 | 737 | 126 | 751 | 111 | **1,759** |
| **BG** | 64 | 146 | 38 | 267 | 100 | **615** |
| **CY** | 46 | 66 | 55 | 70 | 30 | **267** |
| **CZ** | 15 | 165 | 67 | 652 | 181 | **1,081** |
| **DE** | 178 | 1,564 | 774 | 6,289 | 1,978 | **10,782** |
| **DK** | 117 | 695 | 102 | 510 | 76 | **1,500** |
| **EE** | 22 | 39 | 20 | 87 | 13 | **181** |
| **EL** | 261 | 463 | 187 | 895 | 238 | **2,044** |
| **ES** | 757 | 536 | 314 | 1,231 | 263 | **3,102** |
| **FI** | 29 | 139 | 53 | 305 | 81 | **608** |
| **FR** | 1,179 | 2,337 | 830 | 3,944 | 1,094 | **9,384** |
| **HR** | 93 | 42 | 63 | 212 | 61 | **471** |
| **HU** | 12 | 139 | 58 | 580 | 22 | **811** |
| **IE** | 53 | 230 | 89 | 220 | 157 | **749** |
| **IT** | 653 | 540 | 629 | 5,905 | 474 | **8,201** |
| **LT** | 82 | 39 | 30 | 244 | 4 | **398** |
| **LU** | 8 | 12 | 7 | 44 | 7 | **78** |
| **LV** | 27 | 30 | 16 | 134 | 25 | **232** |
| **MT** | 1 | 7 | 5 | 47 | 27 | **86** |
| **NL** | 322 | 884 | 153 | 848 | 83 | **2,290** |
| **PL** | 725 | 553 | 474 | 2,528 | 265 | **4,545** |
| **PT** | 111 | 65 | 228 | 1,303 | 220 | **1,926** |
| **RO** | 613 | 376 | 43 | 1,877 | 543 | **3,452** |
| **SE** | 92 | 305 | 102 | 642 | 144 | **1,285** |
| **SI** | 0.1 | 11 | 14 | 70 | 56 | **151** |
| **SK** | 36 | 142 | 30 | 355 | 12 | **575** |
| **EU** | **5,534** | **10,468** | **4,591** | **30,645** | **6,520** | **57,757** |

*Table 41: Food waste generated, collected and collection potential in 2022 per MS (BIC, 2024).*

| Country | Food waste generated (kt) | % of food waste in collected bio-waste | Food waste collected (kt) | Food waste not collected (kt) |
|---|---|---|---|---|
| **AT** | 1,064 | 20% | 312 | 752 |
| **BE** | 1,228 | 20% | 353 | 875 |
| **BG** | 548 | 0% | 0 | 548 |
| **CY** | 72 | 20% | 2 | 70 |
| **CZ** | 985 | 20% | 154 | 832 |

| | | | | |
|---|---|---|---|---|
| **DE** | 7,858 | 20% | 2,480 | 5,377 |
| **DK** | 608 | 25% | 297 | 311 |
| **EE** | 149 | 20% | 4 | 145 |
| **EL** | 1,493 | 20% | 82 | 1,411 |
| **ES** | 6,830 | 20% | 996 | 5,834 |
| **FI** | 566 | 20% | 85 | 480 |
| **FR** | 8,267 | 20% | 1,406 | 6,861 |
| **HR** | 326 | 20% | 19 | 307 |
| **HU** | 1,066 | 20% | 76 | 990 |
| **IE** | 598 | 20% | 67 | 531 |
| **IT** | 7,538 | 75% | 5,446 | 2,093 |
| **LT** | 341 | 20% | 57 | 283 |
| **LU** | 76 | 20% | 26 | 51 |
| **LV** | 201 | 20% | 14 | 188 |
| **MT** | 59 | 83% | 22 | 37 |
| **NL** | 1,967 | 20% | 542 | 1,425 |
| **PL** | 4,217 | 20% | 392 | 3,826 |
| **PT** | 1,317 | 20% | 178 | 1,139 |
| **RO** | 2,432 | 20% | 57 | 2,375 |
| **SE** | 1,105 | 20% | 171 | 933 |
| **SI** | 228 | 20% | 33 | 196 |
| **SK** | 459 | 20% | 86 | 373 |
| **EU** | **51,598** | | **13,356** | **38,242** |

*Table 42: Bio-waste content (source: EEA, 2020).*

| Country | Food waste (%) | Garden waste (%) | Other bio-waste (%) |
|---|---|---|---|
| **AT** | 0 | 80 | 20 |
| **BE** | 31 | 52 | 18 |
| **BG** | 57 | 43 | 0 |
| **CY** | 72 | 28 | 0 |
| **CZ** | 35 | 61 | 4 |
| **DE** | 52 | 48 | 0 |
| **DK** | 93 | 7 | 0 |
| **EE** | 85 | 12 | 3 |
| **EL** | 93 | 7 | 0 |
| **ES** | 82 | 18 | 0 |
| **FI** | 76 | 10 | 14 |
| **FR** | 43 | 50 | 7 |
| **HR** | 74 | 25 | 2 |
| **HU** | 22 | 54 | 24 |
| **IE** | 79 | 17 | 4 |
| **IT** | 68 | 25 | 6 |
| **LT** | 36 | 39 | 25 |
| **LU** | 63 | 37 | 0 |
| **LV** | 60 | 17 | 23 |

| | | | |
|---|---|---|---|
| **MT** | 96 | 4 | 0 |
| **NL** | 64 | 8 | 28 |
| **PL** | 64 | 36 | 0 |
| **PT** | 75 | 22 | 4 |
| **RO** | 67 | 33 | 0 |
| **SE** | 81 | 19 | 0 |
| **SI** | 59 | 37 | 3 |
| **SK** | 53 | 47 | 0 |

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