

# How can calculation methods affect a common EU target for municipal waste recycling?

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## Abstract

The paper discusses municipal waste strategies for approaching the European Union (EU) recycling targets that were set out in the Commission Decision (2011/753/EU) focused on establishing rules and calculation methods for these targets. We analyse the calculation of recycling targets for municipal waste in 2010 – 2015 by using four calculation methods for the EU member states. We try to assess the differences in interpretations of the EU municipal waste (MW) definitions and the impact that the different recycling rate calculation methods may have on final recycling figures. We discuss significant inconsistencies in the data collection methods as well as interpretations of the definition of MW used to support the decision of the European Parliament from 14 March 2017 claiming that the calculation of recycled MW should be based on one harmonised method that would prevent member states from reporting scrap<sup>1</sup> as recycled waste.

**Keywords:** municipal waste; household waste, mixed municipal waste, recycling rates, recycling calculation methods, circular economy

## Introduction

The European Commission's 2015<sup>1</sup> Circular Economy Action Plan, adopted by the European Parliament on 14 March 2017 regarding the proposal for a directive of the European Parliament and of the Council amending Directive 2008/98/EC on waste COM(2015)0595 – C8-0382/2015 – 2015/0275(COD) brought new challenges for municipal waste (MW) management in Europe, which had become increasingly complex over the last decade<sup>2</sup>. This complexity is to some extent caused by the introduction of additional facilities for pre-treating waste, mainly mechanical biological treatment, and for sorting for recovery. There are also some legal requirements for increasing the recovery of certain waste streams, resulting in increasing cross-order transportation of waste for recovery. Moreover, on 14 June 2018 new waste package has been published in official journal of the European Union with deadline for entry into force 5 July 2020.

Waste policies and targets set at the European Union (EU) level include minimum requirements for managing certain waste types. The most relevant targets for MW are: the Landfill Directive's<sup>3</sup> landfill diversion targets for biodegradable MW; the Packaging and Packaging Waste Directive's<sup>4</sup> recycling targets; and the Waste Framework Directive's (WFD) target<sup>5</sup> for recycling and preparing for reuse (more precisely, the target applies to specific types of household and similar waste). EU member states can choose from among four different methods to monitor their progress towards the most recent target<sup>6</sup>; each monitoring method establishes rules and calculation methods for verifying compliance with the target (a) in Article 11(2) of the WFD, i.e. the target of recycling 50 % of municipal waste by 2020 (55 % by 2025, 60 % by 2030 and 35 % by 2035). In addition, stricter rules for calculating recycling rates will

<sup>1</sup> Scrap is the discarded or rejected material from an operation suitable for reprocessing.

help to better monitor real progress towards the circular economy. The comparability of available EU member state data and indicators may be limited in some cases. There are differences in MW definitions, reported waste types, and data processing. For example, some member states only include waste from households, whereas others may include similar waste from commercial activities and offices<sup>7-10</sup>. Depending on national waste management and waste data collection systems, the approaches for MW data collection established in the member states vary to a large extent, thus hampering data comparability across countries.

We analyse the definitions of MW applied by EU member states. Some member states have changed their definition of MW over time, and recycled amounts can be calculated differently depending on whether they include the weight of materials collected but discarded during the recycling process<sup>7,9</sup>. We present an analysis of the calculation of recycling targets for MW in 2010 – 2015 using the four calculation methods outlined in the EC Decision<sup>6</sup> for all EU member states. We try to assess the differences in interpretation of the EU MW definitions<sup>5-6,11</sup> and the impact that different recycling rate calculation methods may have on the final recycling values presented by Eurostat<sup>1</sup>. We discuss significant inconsistencies in the data capture and the interpretation of the definition of MW to support the decision of the European Parliament (EP) from 14 March 2017<sup>12</sup> on four Directives<sup>4-5,13</sup> concerning waste management, mainly waste from households and small firms, representing 8 % of total waste. These plans produced by the EP are the first step towards creating a circular economy<sup>14</sup> in which products are designed to facilitate reuse. The key issues include how ambitious the targets should be for recycling rates<sup>6</sup>, and how much to limit landfilling, which is probably the most harmful method of waste disposal. The following research questions were set:

*RQ1: How does the definition of MW affect the results of recycling targets?*

*RQ2: How do calculation methods affect the target for municipal waste recycling?*

The paper is structured to present answers to these two research questions: the first sub-chapter provides a concise description of the material and the scientific methods used, focusing on data and sources. The second part of the paper contains the evaluation and exact description of the achieved results and their discussion with previously published papers. Furthermore, we outline the need for further solutions, and the importance of developing this field in research society, and practice. The concluding part of the paper provides a concise summary of the most important findings in relation to the paper focus.

## Materials and Methods

The research was carried out on data collected for 2010 – 2015. The sample consists of the 28 EU 28 member states, as well as Norway, Switzerland, and Iceland.

### European Waste Classification for Statistics and European List of Waste

Waste statistics data were collected in the EU on the basis of an OECD/Eurostat joint questionnaire (JQ) until the adoption of Regulation (EC) 2150/2002<sup>15-16</sup>, the Waste Statistics Regulation. Municipal waste (MW) includes household waste and similar waste explained in detail in Annexes I and II<sup>11,17-18</sup> from origination, collecting, and waste materials<sup>2</sup>.

To understand how consistently the definition of MW is applied across the 28 EU member states, an analysis was carried out<sup>7,10</sup> to compare the situation in the member states, focusing on which materials each member state includes in its definition of MW and on their recycling rate calculations (Table 1).

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<sup>2</sup> The most comprehensive definition for statistics on MW is still the simple definition provided by the OECD/Eurostat JQ (Eurostat, 2016): Municipal waste covers household waste and waste similar in nature and composition to household waste.

**Table 1: Waste materials included in the national definitions of MW**

Main Material Category	Material Subcategory	Country
Residual waste, bulky waste	Reused products	Finland, Ireland
	Material recyclables (paper and cardboard, textiles, plastics, glass, metals, and other recyclables, such as wood waste)	EU-28
	Packaging waste from the private sector	EU-28 except for the Czech Republic, Estonia, Finland, France, Germany, Latvia and Romania
	Biowaste (food waste and garden waste)	EU-28
	Hazardous household waste	EU-28 except for Cyprus
Waste from municipal services comprises the following fractions:	Street sweepings	EU-28
	Biowaste (garden and park waste, maintenance of roadsides, cemetery waste)	EU-28
	Kitchen and canteen waste	EU-28
Waste from commerce and trade, small businesses, office buildings and institutions	Collected by households or by municipal services	EU-28
	Collected by private sector	EU-28 except for Latvia, Netherlands and Spain
Other waste from municipal services	C&D waste	Romania
	Waste from municipal sewage networks and treatment	Germany, Romania

**Source: Greenfield, 2015 and authors**

The Waste Statistics Regulation obliges the member states to report statistical data on waste generation and waste treatment according to the European Waste Classification for Statistics (EWC-Stat). The EWC-Stat is a mainly substance-oriented aggregation of the waste types defined in the European List of Wastes (LoW)<sup>5</sup>. The result is a 1:n - relationship between EWC-Stat and LoW which allows for the unambiguous conversion of the waste types classified according to the LoW into the EWC-Stat waste categories. The transposition table between the EWC-Stat and the LoW is established in Annex III of the (EC) 2150/2002<sup>15-16</sup>, the Waste Statistics Regulation<sup>16</sup>. The EWC-Stat categories that have to be reported to Eurostat are set out in section 2 of Annexes I and II<sup>10</sup>. Whereas the Waste Statistics Regulation stipulates that the EWC-Stat has to be used for reporting the data to Eurostat, it does not prescribe a specific classification to be used for data collection. Countries may use any waste classification as long as they can produce the defined formats in the quality required. In practice, most of the countries collect their data according to the LoW and convert it subsequently into the required EWC-Stat categories based on the transposition table in Annex III of the Waste Statistics Regulation<sup>10</sup>. The direct use of the EWC-Stat for data collection is applied only by few countries. For the countries that use the EWC-Stat for data collection, the guidance document<sup>2</sup> is particularly help in clarifying which wastes are covered by the defined reporting categories.

## Recycling target calculation methods

To verify compliance with the MW target set in Article 11(2)(a) of the WFD<sup>5</sup>, EU member states would apply a recycling target to one of the following:

- 1) the preparation for reuse and recycling of paper, metal, plastic, and glass household waste;
- 2) the preparation for reuse and recycling of paper, metal, plastic, glass household waste, and other single types of household waste or similar waste from other origins;
- 3) the preparation for reuse and recycling of household waste;
- 4) the preparation for reuse and recycling of municipal waste.

The EC Decision<sup>6</sup> specified the use of one of four calculation methods for the calculation of the recycling target:

- 1) Calculation method 1 (in %):

$$\frac{\text{Recycling rate of paper, metal, plastic, and glass household waste} = \text{(Recycled amount of paper, metal, plastic, and glass household waste)}}{\text{(Total generated amount of paper, metal, plastic, and glass household waste)}}$$

- 2) Calculation method 2 (in %):

$$\frac{\text{Recycling rate of household and similar waste} = \text{(Recycled amount of paper, metal, plastic, and glass waste and other single waste streams from households or similar waste streams)}}{\text{(Total generated amount of paper, metal, plastic, and glass waste and other single waste streams from households or similar waste)}}$$

- 3) Calculation method 3 (in %):

$$\frac{\text{Recycling rate of household waste} = \text{(Recycled amount of household waste)}}{\text{(Total household waste amounts excluding certain waste categories)}}$$

- 4) Calculation method 4 (in %):

$$\frac{\text{Recycling of municipal waste} = \text{(Municipal waste recycled)}}{\text{(Municipal waste generated)}}$$

## Results and discussion

The possibility of using four calculation methods regarding the 2020 recycling target for MW is maintained mainly because of legal certainty and to minimize any short-term disruption to the waste management plans adopted by several EU member states. The method used to determine the recycling rate differs for every EU member state<sup>7,9-10</sup>.

Table 2 summarizes these methods for 28 EU member states, Norway, Switzerland, and Iceland. This table does not cover the potential of recycling materials from mixed municipal waste (MMW). There is a great deal of additional recycling potential in the MMW (mainly the household waste) produced by member states. The additional recycling potential concerns particularly separately collected paper and cardboard, plastic, and biowaste. Member states calculate this potential with different weights. Table 2 shows that methods 2 and 4 have been adopted by 23 of the 31 states of the European Free Trade Association (EFTA) that were considered. Focusing on the aspect of certain waste types similarity to household waste, Eurostat's Guidance on municipal waste data collection<sup>11</sup> offers an option allowing the scope of MW to be expressed in terms of the European LoW<sup>18</sup>.

**Table 2: Methods of calculating MW recycling rate in different countries of the European Free Trade Association in 2015**

Method 1	Method 2	Method 3	Method 4	Method
Recycling rate of paper, metal, plastic, and glass household waste [%]	Recycling rate of household and similar waste [%]	Recycling rate of household waste [%]	Recycling of municipal waste [%]	Currently not signed up to one of the four methods
Ireland Malta	Austria Croatia Cyprus Czechia Estonia France Greece Hungary Italy Lithuania Poland Portugal Romania Slovakia Sweden	Bulgaria Luxembourg United Kingdom	Belgium Denmark Finland Germany Latvia Netherlands Slovenia Spain	Norway Switzerland Iceland
2	15	3	8	3

Source: EEA (2015) and authors

This option is based on the principle that the scope of MW includes household waste and similar waste types generated by sources other than households, regardless of whether municipalities or private actors are responsible for their collection. Recent experience demonstrates that a relevant number of member states include amounts of mixed municipal waste (MMW) (i.e. LoW code 20 03 01) from all business economy sector - NACE Rev. 2<sup>19</sup> activities in the MW data (group 38 of NACE). Furthermore, one can argue that the overall target is to reduce the unsorted MMW or residual household waste (RHW), regardless of its origin. If this is to be done, it is consistent to cover the separately collected fractions from all origins as well. Source-segregated material fractions found in residual household waste (EWC-Stat/version 4 code 10.1) are considered as mis-sorted waste fractions. Housing types are divided into single-family and multi-family houses. Here, the term 'single-family house' corresponds to households with their own residual waste bin, while 'multi-family house' corresponds to households sharing residual waste bins, e.g. common containers in blocks of flats. Therefore, the starting point for the waste types to be included are the waste codes listed in Chapter 20 of the LoW, with some additions from subchapter 15 01<sup>18</sup>. When discarded items are handed over to the waste management system, they are classified as a certain waste type, ideally by 6-digit codes according to the LoW<sup>18</sup> or another (national) classification. The weight and code are usually registered at the weighbridge of a waste management facility. Thus, the key to any definition of MW is certainly the material classification of the waste, since this classification best determines its similarity to household waste 'in nature and composition'.

The scope of recycled MW materials is based on selected LoW codes, which are specified in Table 3 along with EWC-Stat/Version 4 codes for recycling target calculation, as member states have to submit an annual national waste report based on the Waste Statistics Regulation<sup>16</sup>. Member state implementation reports on MW recycling targets should comply with the specific requirements set out in Annexes I and II<sup>6</sup>, see Table 3. However, member states may use different weights for collected waste materials (specified by LoW codes). Eurostat has collected and published data on MW since 1995. These data are widely used for comparing MW generation and treatment in different countries, and indicators relevant to MW are used to monitor European waste policies<sup>20</sup>. The data on MW expressed in kilograms per capita are part of a set of indicators compiled annually to monitor the EU's sustainable development strategy<sup>2</sup>.

**Table 3 Municipal waste materials and relevant LoW and EWC-Stat/Version 4 codes for calculation methods 1, 2, and 3 of Annex II (EC, 2011)**

Waste materials	LoW code according to (EC, 2011)	EWC-Stat codes according to (EC, 2002, 2010)
Paper and cardboard	20 01 01, 15 01 01	07.2
Metals	20 01 40, 15 01 04	06
Plastic	20 01 39, 15 01 02	07.4
Glass	20 01 02, 15 01 07	07.1
Biodegradable kitchen and canteen waste	20 01 08	09 (excl. 9.11, 9.3)
Biodegradable garden and park waste	20 02 01	09 (excl. 9.11, 9.3)
Non-biodegradable garden and park waste	20 02 02, 20 02 03	12 (excl. 12.4, 12.6)
Wood	20 01 38, 15 01 03	07.5
Textiles	20 01 10, 20 01 11, 15 01 09	07.6
Batteries	20 01 34, 20 01 33*	08.41
Discarded equipment	20 01 21*, 20 01 23*, 20 01 35*, 20 01 36	08 (excl. 08.1, 08.41)
Other municipal waste	20 03 01, 20 03 02, 20 03 07, 15 01 06	10.1, 09 (excl. 9.11, 9.3)

Source: (EC, 2011; Eurostat, 2012)

**Table 4: Municipal waste generated by country in selected years in kilograms per capita**

	1995	2000	2005	2010	2015
EU-28	-	521	515	504	477
EU-27	473	523	517	505	477
Belgium	455	471	482	456	419
Bulgaria	694	612	588	554	419
Czechia	302	335	289	318	316
Denmark	521	664	736	-	789
Germany	623	642	565	602	625
Estonia	371	453	433	305	359
Ireland	512	599	731	624	-
Greece	-	412	442	532	-
Spain	505	653	588	510	434
France	475	514	530	533	502
Croatia	-	262	336	379	393
Italy	454	509	546	547	486
Cyprus	595	628	688	689	638
Latvia	264	271	320	324	433
Lithuania	426	365	387	404	448
Luxembourg	587	654	672	679	625
Hungary	460	446	461	403	377
Malta	387	533	623	601	624
Netherlands	539	598	599	571	523
Austria	437	580	575	562	560
Poland	285	320	319	316	286
Portugal	352	457	452	516	-
Romania	342	355	383	313	-
Slovenia	596	513	494	490	449
Slovakia	295	254	273	319	329
Finland	413	502	478	470	500
Sweden	386	428	477	439	447
United Kingdom	498	577	581	509	485
Iceland	426	462	516	481	:
Norway	624	613	426	469	421
Switzerland	600	656	661	708	725

Source: Eurostat<sup>22-26</sup>

Table 4 shows municipal waste generation by EU and EFTA countries expressed in kilograms per capita. To illustrate the trends, Table 4 shows generated MW for selected years, covering the period 1995 to 2015.

Using data from Eurostat, we can calculate the recycling of MW by country in kilograms per capita and the MW recycling rate by country as a percentage of generated MW in the period 2010-2015 (Table 5).

**Table 5: Shared recycling of MW by EFTA countries in kilograms per capita [kg/citizen] and as a percentage of total MW [%] in 2010 – 2015**

Country	2010		2011		2012		2013		2014		2015	
	kg/ cit.	%	kg/ cit.	%	kg/ cit.	%	kg/ cit.	%	kg/ cit.	%	kg/ cit.	%
EU-28	124	24.6	128	25.7	130	26.8	128	26.8	134	28.1	137	28.7
EU-27	125	24.8	129	25.8	131	26.9	129	26.9	135	28.1	137	28.7
Ireland	200	32.0	188	30.5	181	30.8	-	-	-	-	-	-
Malta	32	5.2	46	7.8	45	7.7	48	8.1	45	7.4	42	6.7
<b>Calculation method 1</b>	<b>116.0</b>	<b>18.6</b>	<b>117.0</b>	<b>19.2</b>	<b>113.0</b>	<b>19.3</b>	<b>48.0</b>	<b>8.1</b>	<b>45.0</b>	<b>7.4</b>	<b>42.0</b>	<b>6.7</b>
Austria	152	27.1	137	23.8	139	23.9	142	24.5	144	25.5	144	25.7
Croatia	12	3.3	29	7.5	51	13.2	54	13.2	56	14.4	64	16.3
Cyprus	74	10.7	85	12.6	81	12.3	81	13.1	83	13.5	85	13.3
Czechia	43	13.6	47	14.8	63	20.6	65	21.3	70	22.6	81	25.5
Estonia	31	10.1	44	14.5	40	14.0	37	12.7	95	26.6	89	24.7
France	95	17.8	111	20.6	110	21.1	111	21.5	112	22.1	112	22.3
Greece	78	14.7	75	14.9	79	15.6	-	-	-	-	-	-#
Hungary	64	15.9	66	17.2	84	20.9	81	21.4	94	24.3	98	25.9
Italy	103	18.8	120	22.8	121	23.9	122	24.8	127	26.1	126	25.9
Lithuania	14	3.4	81	18.2	87	19.6	88	20.4	91	21.1	103	22.9
Poland	47	14.8	31	9.7	33	10.3	39	13.3	57	21.1	75	26.4
Portugal	59	11.3	56	11.5	52	11.5	57	12.9	74	16.2	-	-
Romania	8	2.6	9	3.3	8	3.3	11	4.2	13	5.2	14	5.7
Slovakia	18	5.7	19	6.2	26	8.4	20	6.6	16	5.1	25	7.6
Sweden	151	34.4	149	33.1	147	32.7	150	33.4	146	33.4	145	32.4
<b>Calculation method 2</b>	<b>63.3</b>	<b>13.6</b>	<b>70.6</b>	<b>15.4</b>	<b>74.7</b>	<b>16.8</b>	<b>75.6</b>	<b>17.4</b>	<b>84.1</b>	<b>19.8</b>	<b>89.3</b>	<b>21.1</b>
Bulgaria	136	24.5	122	24.0	103	22.3	108	25.1	94	21.2	80	19.0
Luxembourg	183	27.0	188	28.4	182	27.7	174	28.4	178	28.4	178	28.4
United Kingdom	129	25.3	129	26.2	128	26.9	132	27.4	132	27.3	132	27.2
<b>Calculation method 3</b>	<b>149.3</b>	<b>25.6</b>	<b>146.3</b>	<b>26.2</b>	<b>137.7</b>	<b>25.6</b>	<b>138.0</b>	<b>27.0</b>	<b>134.7</b>	<b>25.6</b>	<b>130.0</b>	<b>24.9</b>
Belgium	153	33.6	155	33.9	144	32.2	138	31.6	141	33.0	143	34.3
Denmark	-	-	213	27.3	203	25.7	205	26.0	212	26.9	215	27.3
Finland	92	19.7	110	21.8	109	21.5	94	19.0	87	18.0	141	28.1
Germany	<b>275</b>	<b>45.6</b>	<b>288</b>	<b>46.1</b>	<b>293</b>	<b>47.4</b>	<b>286</b>	<b>46.6</b>	<b>300</b>	<b>47.6</b>	<b>299</b>	<b>47.8</b>
Latvia	28	8.8	30	8.6	41	13.7	71	20.2	85	23.4	92	21.2
Netherlands	142	24.8	137	24.2	131	23.9	126	23.9	125	23.7	129	24.6
Slovenia	<b>99</b>	<b>20.2</b>	<b>126</b>	<b>30.3</b>	<b>131</b>	<b>36.3</b>	<b>116</b>	<b>28.0</b>	<b>126</b>	<b>29.0</b>	<b>208</b>	<b>46.4</b>
Spain	90	17.6	81	16.7	91	19.5	70	15.5	76	16.9	73	16.8
<b>Calculation method 4</b>	<b>32</b>	<b>5.2</b>	<b>46</b>	<b>7.8</b>	<b>45</b>	<b>7.7</b>	<b>48</b>	<b>8.1</b>	<b>45</b>	<b>7.4</b>	<b>42</b>	<b>6.7</b>
Norway	111.0	20.4	118.0	22.3	122.0	24.8	119.5	23.7	126.2	24.7	140.5	27.3
Switzerland	125	26.5	121	24.9	124	25.9	116	23.4	110	26.1	110	26.2
Iceland	239	33.7	238	34.6	241	34.8	236	33.6	238	32.6	231	31.9

Source: Authors based on Eurostat<sup>22-26</sup>

It will be very difficult for most European countries to reach the 50% recycling target in 2020 when the recycling rate for the EU-28 was 28.7 % in 2015: linear extrapolation suggests the rate will be 32.6 % in 2020. This is especially likely to be true if Eurostat<sup>11</sup> does not recommend adding the amount of composted or fermented MW to the recycling rate. The exception among European countries is Germany; its high recycling rates will enable it to reach a 50 % recycling rate in 2020.

**Table 6: Shared recycling and composting of MW by EFTA countries in kilograms per capita [kg/citizen] and as a percentage of total MW [%] in 2010 – 2015**

Country	2010		2011		2012		2013		2014		2015	
	kg/cit.	%	kg/cit.	%	kg/cit.	%	kg/cit.	%	kg/cit.	%	kg/cit.	%
EU-28	193	38.3	197	39.6	202	41.5	202	42.2	209	43.7	215	45.0
EU-27	194	38.5	198	39.8	203	41.7	203	42.4	211	43.9	216	45.2
Ireland	223	35.7	222	36.1	215	36.6	-	-	-	-	-	-
Malta	32	5.2	53	9.0	57	9.7	48	8.1	45	7.4	42	6.7
<b>Calculation method 1</b>	<b>127.5</b>	<b>20.5</b>	<b>137.5</b>	<b>22.6</b>	<b>136.0</b>	<b>23.2</b>	<b>48.0</b>	<b>8.1</b>	<b>45.0</b>	<b>7.4</b>	<b>42.0</b>	<b>6.7</b>
Austria	<b>334</b>	<b>59.4</b>	<b>325</b>	<b>56.7</b>	<b>335</b>	<b>57.7</b>	<b>334</b>	<b>57.7</b>	<b>319</b>	<b>56.3</b>	<b>319</b>	<b>56.9</b>
Croatia	15	4.0	32	8.3	57	14.7	61	14.9	64	16.5	71	18.0
Cyprus	74	10.7	85	12.6	89	13.6	90	14.6	104	17.0	115	17.9
Czechia	50	15.8	54	17.0	71	23.2	74	24.2	79	25.4	94	29.7
Estonia	55	18.2	71	23.3	54	19.1	52	17.9	112	31.3	102	28.3
France	186	34.9	199	36.9	197	37.8	199	38.6	199	39.2	199	39.5
Greece	91	17.1	91	18.0	98	19.3	-	-	-	-	-	-
Hungary	79	19.6	84	22.0	102	25.5	100	26.4	118	30.5	121	32.2
Italy	170	31.0	187	35.5	194	38.4	194	39.4	207	42.5	212	43.5
Lithuania	20	4.9	89	19.9	104	23.5	120	27.8	132	30.5	149	33.1
Poland	68	21.4	56	17.5	63	19.6	71	24.2	87	32.3	121	42.5
Portugal	97	18.7	98	20.1	118	26.1	114	25.8	138	30.4	-	-
Romania	40	12.8	31	11.7	37	14.8	34	13.2	33	13.1	32	13.1
Slovakia	29	9.1	32	10.3	41	13.3	33	10.8	33	10.3	49	14.9
Sweden	211	48.1	213	47.3	212	47.2	219	48.7	218	49.9	215	48.0
<b>Calculation method 2</b>	<b>101.3</b>	<b>21.7</b>	<b>109.8</b>	<b>23.8</b>	<b>118.1</b>	<b>26.3</b>	<b>121.1</b>	<b>27.4</b>	<b>131.6</b>	<b>30.4</b>	<b>138.4</b>	<b>32.1</b>
Bulgaria	136	24.5	133	26.2	116	25.0	123	28.5	102	23.1	123	29.4
Luxembourg	316	46.5	308	46.4	310	47.4	285	46.6	299	47.7	302	48.0
United Kingdom	205	40.2	207	42	203	42.6	208	43.3	211	43.7	211	43.5
<b>Calculation method 3</b>	<b>219.0</b>	<b>37.1</b>	<b>216.0</b>	<b>38.2</b>	<b>209.7</b>	<b>38.3</b>	<b>205.3</b>	<b>39.5</b>	<b>204.0</b>	<b>38.2</b>	<b>212.0</b>	<b>40.3</b>
Belgium	<b>250</b>	<b>54.9</b>	<b>248</b>	<b>54.3</b>	<b>237</b>	<b>53.1</b>	<b>230</b>	<b>52.7</b>	<b>228</b>	<b>53.2</b>	<b>223</b>	<b>53.4</b>
Denmark	-	-	324	41.5	333	42.1	341	43.2	356	45.1	365	46.3
Finland	154	32.8	176	34.8	169	33.3	161	32.5	157	32.5	203	40.6
Germany	<b>376</b>	<b>62.5</b>	<b>394</b>	<b>63.0</b>	<b>403</b>	<b>65.2</b>	<b>392</b>	<b>63.8</b>	<b>414</b>	<b>65.6</b>	<b>413</b>	<b>66.1</b>
Latvia	30	9.4	34	9.7	47	15.8	91	25.9	98	27.0	116	26.7
Netherlands	<b>281</b>	<b>49.2</b>	<b>278</b>	<b>49.1</b>	<b>271</b>	<b>49.4</b>	<b>263</b>	<b>49.8</b>	<b>268</b>	<b>50.9</b>	<b>271</b>	<b>51.7</b>
Slovenia	<b>110</b>	<b>22.4</b>	<b>148</b>	<b>35.6</b>	<b>152</b>	<b>41.9</b>	<b>144</b>	<b>34.8</b>	<b>156</b>	<b>36.0</b>	<b>242</b>	<b>54.1</b>
Spain	149	29.2	130	26.7	139	29.8	147	32.5	138	30.8	144	33.3
<b>Calculation method 4</b>	<b>183.3</b>	<b>34.3</b>	<b>193.3</b>	<b>36.5</b>	<b>196.8</b>	<b>39.2</b>	<b>199.7</b>	<b>39.9</b>	<b>205.2</b>	<b>40.5</b>	<b>231.5</b>	<b>45.4</b>
Norway	198	42.1	194	39.9	190	39.8	194	39.2	178	42.2	180	42.8
Switzerland	<b>357</b>	<b>50.5</b>	<b>345</b>	<b>50.1</b>	<b>347</b>	<b>50.0</b>	<b>358</b>	<b>51.0</b>	<b>391</b>	<b>53.5</b>	<b>382</b>	<b>52.7</b>
Iceland	100	20.9	125	25.3	144	28.0	155	29.9	160	29.7	-	-

Source: Authors based on Eurostat <sup>22-26</sup>

Germany's recycling rates are driven by its waste management policy and initiatives. EU legislation under the WFD<sup>5</sup>, for example, sets the policy framework and targets for recycling in Germany, which was one of the first European countries to limit landfilling and introduce schemes for collecting packaging waste, bio-waste, and waste paper separately. The shared recycling and composting or fermentation rates for MW in European countries in the period 2010 – 2015 is shown in Table 6.

For 2015, the recycling and composting or fermentation rates for MW vary between member states considerably, ranging from 66.1 % in Germany to 6.7 % in Malta. The EU-28 average was 45.2 %. The variations reflect differences in applied technologies, but depend also on how MW is collected, sorted, and managed. Linear extrapolation suggests the average EU-28 rate would reach 51.8% in 2020. In 2015, five EU member states achieved the WFD's 50 % EU recycling target; nevertheless, they did so by including biowaste, which was composted/fermented in the calculations: Austria (56.9 %) (method 2), Germany (66.1%), Belgium (53.4 %), Slovenia (54.1) and the Netherlands (51.7 %) (method 4). Table 6 also shows that methods 3 and 4 have higher average recycling rates than methods 1 and 2. Member



states using method 4 in particular have higher recycling rates. Only Latvia has a recycling rate lower than 30 % (26.7 %).

Table 7 shows the sum of household and similar waste generated by households by year in waste categories 10.1 defined by EWC-Stat 4<sup>15-17</sup>, and shows this sum as a percentage of total generated MW.

**Table 7: Waste generated by households in EU countries by year (in EWC-STAT 4 waste categories 10.1) in kilograms per capita and as a percentage of total MW generation**

Country	2010		2012		2014	
	kg/ cit.	% of MW	kg/ cit.	% of MW	kg/ cit.	% of MW
EU-28	275	62.9	260	61.2	243	59.1
Belgium	147	26.9	174	31.6	169	33.6
Bulgaria	324	67.9	262	69.5	274	73.9
Czechia	258	81.1	241	78.2	231	74.5
Denmark	334	52.2	336	56.4	316	52.1
Germany	197	44.4	194	42.8	192	42.1
Estonia	122	37.8	128	38.8	153	41.7
Ireland	303	79.9	287	79.5	256	77.6
Greece	413	88.4	377	85.7	363	87.7
Spain	413	82.9	380	83.7	365	84.1
France	278	61.5	270	59.0	252	58.6
Croatia	-	-	246	88.2	238	86.9
Italy	361	65.9	309	61.3	275	56.4
Cyprus	-	-	119	22.8	86	17.7
Latvia	187	56.5	301	50.5	208	58.4
Lithuania	244	60.0	261	66.2	256	64.6
Luxembourg	222	45.0	208	44.3	197	45.1
Hungary	236	82.5	220	81.5	260	87.0
Malta	278	77.0	233	65.4	236	65.4
Netherlands	265	48.4	253	47.8	236	46.7
Austria	180	32.5	196	41.1	198	40.6
Poland	220	94.0	228	93.1	181	83.4
Portugal	470	91.3	413	91.8	410	90.5
Romania	220	86.3	186	82.3	176	91.7
Slovenia	247	69.6	174	55.8	134	49.1
Slovakia	270	84.6	255	83.3	258	80.6
Finland	160	51.1	178	55.6	138	46.9
Sweden	230	53.4	241	54.8	173	40.2
United Kingdom	261	57.2	238	55.3	229	53.4

Source: Authors based on Eurostat<sup>22-26</sup>

Household and similar waste (EWC-STAT 4 code 10.1) present the sum of the amount of waste corresponding to the following LoW codes: 20 03 01 mixed municipal waste; 20 03 02 waste from markets; 20 03 07 bulky waste; 20 03 99 municipal wastes not otherwise specified; 20 03 03 street-cleaning residues. The data summarised in Table 7 concerning waste generated by households is considered to be RHW and mostly consists of mixed municipal waste (LoW code 20 03 01) and bulky waste (LoW code 20 03 07). It reflects the large potential for increasing the MW recycling rate in several EU member states with respect to the composition of collected MMW, which is mostly disposed of via landfilling<sup>3</sup>.

<sup>3</sup> Landfilling of waste makes no sense in a circular economy and can pollute water, soil and air. By 2035 the amount of municipal waste landfilled must be reduced to 10% or less of the total amount of municipal waste generated.

## Conclusions

There are large differences among EU member states with respect to their waste management performance, particularly regarding the recycling of MW. On 14 March 2017 the EP proposed that the member states that recycled less than 20% of their MW in 2013 (see Table 5), and were not considered at risk of failing to achieve the target of preparing for the reuse and recycling of at least 55% of their MW by 2025, should be given additional time to comply with the preparations for the reuse and recycling targets established for 2025<sup>21</sup>. Those member states could also be given additional time to comply with the preparations for the reuse and recycling targets established for 2030, if they are not considered at risk of failing to achieve the target of reusing and recycling at least 60% of their MW by 2030<sup>21</sup>. In light of average annual progression rates observed in member states over the past fifteen years, those member states would need to increase their recycling capacity to the levels that are well above past averages to meet those targets. In order to ensure that steady progress towards the targets is made and that implementation gaps are tackled in time, member states that are given additional time should meet interim targets and establish implementation plans, the effectiveness of which should be assessed by the EC on the basis of defined criteria. In new waste package have been identified in the monitoring framework which will be continuously updated on the website dedicated to monitoring framework. The ten indicators are: EU self-sufficiency for raw materials, green public procurement, waste generation, food waste, overall recycling rates, recycling rates for specific waste streams, contribution of recycled materials to raw materials demand, trade in recyclable raw materials, private investments, jobs and gross value added and patents.

Germany, with high recycling rates that would enable it to reach the 50% recycling rate by 2020, is an exception among European countries. Germany's recycling rates are driven by its waste management policy and initiatives. EU legislation under the WFD<sup>5</sup>, for example, sets the policy framework and targets for recycling in Germany, which was one of the first European countries to limit landfilling and to introduce schemes for collecting packaging waste, bio-waste, and waste paper separately.

Despite separate collection, a lot of recyclables still end up in RHW/MMW, see Table 7. With high-quality sorting, especially optical sorting, a considerable amount of materials can be sorted from the residual waste and subsequently recycled and reprocessed into secondary raw materials. Member states should thus also take measures to ensure that waste that is not separately collected is sorted.

In order to ensure the uniform calculation of data on preparations for reuse and recycling targets, the EC should adopt detailed rules on the determination of recognised preparations for reuse operators, deposit-refund schemes, and final recycling operators, including specific rules on waste collection, traceability, verification, and reporting, as well as on the quality criteria for metals that have been recycled in conjunction with incineration or co-incineration. To calculate whether the preparations have been made for reuse and recycling targets, and after the adoption of the harmonised calculation method, EU member states should be able to consider using ways of recycling metals that take place in conjunction with incineration or co-incineration, such as energy recovery<sup>21</sup>.

Compliance with the obligation to set up separate collection systems for paper, metal, plastic<sup>4</sup>, glass, textile, and biowaste is essential to achieving the agreed reuse and recycling rates in EU member states. In addition, biowaste should be collected separately and recycled in order to contribute to an increase in preparations to meet target reuse and recycling rates, and to the protection of dry recyclable materials from contamination, as well as to prevent incineration and landfilling. Therefore, research on possible collection and recycling systems for other waste streams and new materials should be encouraged and intensified.

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<sup>4</sup> Single use plastic directive requires mandatory to produce beverage containers composed of at least 35% of recycled plastic by 2025 content; collecting up to 90 % of bottles in 2025; plastic ban in certain products; labelling requirements; fishing gear producer responsibility; obligations for producers (focus EPR) and Awareness-raising measures.

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## Jak mohou metody výpočtu ovlivnit společný cíl EU pro recyklaci komunálního odpadu?

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### Souhrn

Článek se zabývá strategií komunálního odpadu pro dosažení cílů recyklace Evropské unie (EU), které byly stanoveny v rozhodnutí Komise (2011/753 / EU) zaměřeném na stanovení pravidel a metod výpočtu těchto cílů. Analyzujeme 4 metody výpočtu recyklačních cílů komunálního odpadu v období 2010 - 2015 pro členské státy EU. Snažíme se zhodnotit rozdíly mezi interpretacemi definic komunálního odpadu a dopadů, které mohou mít různé metody výpočtu míry recyklace na konečné údaje o recyklaci. Diskutujeme významné nesrovnalosti v metodách sběru dat a interpretacích definice komunálního odpadu, které byla použita k podpoře rozhodnutí Evropského parlamentu ze dne 14. března 2017 a nového balíčku z 14 června 2018, podle něhož by výpočet recyklovaného komunálního odpadu měl vycházet z jedné harmonizované metody, která by členskými státy bránila v hlášení výmětu jako recyklovaného odpadu.

**Klíčová slova:** komunální odpad, domácí odpad, směsný komunální odpad, míry recyklace, metody výpočtu recyklace, oběhové hospodářství.