



# Dynamic visualisation of municipal waste management performance in the EU using Ternary Diagram method



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## ABSTRACT

This contribution describes the dynamic visualisation of European (EU 28) municipal waste management performance, using the Ternary Diagram Method. Municipal waste management performance depends primarily on three treatment categories: recycling & composting, incineration and landfilling. The framework of current municipal waste management including recycling targets, etc. is given by the Waste Framework Directive – 2008/98/EC. The proposed Circular Economy Package should stimulate Europe's transition towards more sustainable resources and energy oriented waste management. The Package also includes a revised legislative proposal on waste that sets ambitious recycling rates for municipal waste for 2025 (60%) and 2030 (65%). Additionally, the new calculation method for monitoring the attainment of the targets should be applied.

In 2014, ca. 240 million tonnes of municipal waste were generated in the EU. While in 1995, 17% were recycled and composted, 14% incinerated and 64% landfilled, in 2014 ca. 71% were recovered but 28% landfilled only. Considering the treatment performance of the individual EU member states, the EU 28 can be divided into three groups, namely: “Recovery Countries”, “Transition Countries” and “Landfilling Countries”.

Using Ternary Diagram Method, three types of visualization for the municipal waste management performance have been investigated and extensively described. Therefore, for better understanding of municipal waste management performance in the last 20 years, dynamic visualisation of the Eurostat table-form data on all 28 member states of the EU has been carried out in three different ways: 1. “Performance Positioning” of waste management unit(s) at a specific date; 2. “Performance dynamics” over a certain time period and; 3. “Performance development” expressed as a track(s).

Results obtained show that the Ternary Diagram Method is very well suited to be used for better understanding of past developments and coherences, for monitoring of current situations and prognosis of future paths. One of the interesting coherences shown by the method is the linked development of recycling & composting (60–65%) with incineration (40–35%) performance over the last 20 years in the EU 28.

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## 1. Introduction

The European Directive on waste (2008/98/EC) (Waste Framework Directive – WFD) sets definitions and issues the basic concept for development of sustainable waste management in the EU. In the directive, the definition of, among others, “waste management”, “treatment”, “recycling”, “recovery” and “disposal” is given as follows (EU, 2008):

- ““waste management” means the collection, transport, recovery and disposal of waste, including the supervision of such operations and the after-care of disposal sites, and including actions taken as a dealer or broker,
- “treatment” means recovery or disposal operations, including preparation prior to recovery or disposal,
- “recycling” means any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for back-filling operations,

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- “recovery” means any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy. Annex II sets out a non-exhaustive list of recovery operations; and
- “disposal” means any operation which is not recovery even where the operation has as a secondary consequence the reclamation of substances or energy. Annex I sets out a non-exhaustive list of disposal operations.”

To reach the sustainability in waste management (i.e. treatment of waste in proper way and production of secondary raw materials and energy resources), following waste hierarchy should be applied according to the directive (EU, 2008):

1. “Prevention,
2. Preparing for re-use,
3. Recycling,
4. Other recovery, e.g. energy recovery; and
5. Disposal.”

When applying the waste hierarchy, member states shall take measures to encourage the options that deliver the best overall environmental outcome, take into account the principles of environmental (human, nature, etc.) protection as well as technical feasibility and economical viability. In Article 11 of the directive, re-use and recycling measures and goals are set. Therefore, a separate collection for at least paper, plastic, metal and glass from households and possibly from other origins as far as these waste streams are similar to waste from households was to be set up by 2015, considering technical, environmental and economical aspects. Finally by 2020, the preparation for re-use and the recycling of before mentioned waste fractions shall be increased to a minimum of overall 50% by weight. (EU, 2008).

For verifying compliance with the targets (regarding Article 11 - WFD) and the performance of member states, Commission has established rules and calculation methods (EU, 2011). In the Commission decision (EU, 2011) the definition for different waste is given that is relevant for present paper:

- “household waste” means any waste generated by households,
- “similar waste” means waste in nature and composition comparable to household waste, excluding production waste and waste from agriculture and forestry; and
- “municipal waste” means household waste and similar waste.

For the purposes of verifying compliance with the targets on municipal waste according to the WFD, member states shall apply one of the following calculation methods (EU, 2011):

1. “The preparation for reuse and the recycling of paper, metal, plastic and glass household waste” (note: abbreviation for paper, metal, plastic and glass household waste is PMPG HW), see Eq. (1).

Recycling rate of PMPG HW, in %

$$= \frac{\text{Recycled amount of PMPG HW}}{\text{Total generated amount of PMPG HW}} \quad (1)$$

2. “The preparation for reuse and the recycling of PMPG HW and other single types of household waste or of similar waste from other origins”, see Eq. (2).

Recycling rate of household and similar waste, in %

$$= \frac{\text{Recycled amount of PMPG and other single waste streams from households or similar waste streams}}{\text{Total generated amount of PMPG and other single waste streams from households or similar waste}} \quad (2)$$

3. “The preparation for reuse and the recycling of household waste”, see Eq. (3).

Recycling rate of household waste, in %

$$= \frac{\text{Recycled amount of household waste}}{\text{Total household waste amounts excluding certain waste categories}} \quad (3)$$

4. “The preparation for reuse and the recycling of municipal waste”, see Eq. (4).

Recycling of municipal waste, in %

$$= \frac{\text{Municipal waste recycled}}{\text{Municipal waste generated}} \quad (4)$$

### 1.1. Current status of municipal waste management in the EU

In the EU 28, ca. 2.5 billion tonnes of waste are produced annually (Eurostat, 2016a). Municipal waste accounts for ca. 10% (ca. 240 million tonnes in 2014) of total waste generated only (Eurostat, 2016b). However, it is very important because of, among others, its complex characteristics, due to its composition and biological activity, etc.

Eurostat has collected and published data on municipal waste since 1995. Fig. 1 shows municipal waste generation by country (data in thousand tonnes per year) for 2014 (Eurostat, 2016b).

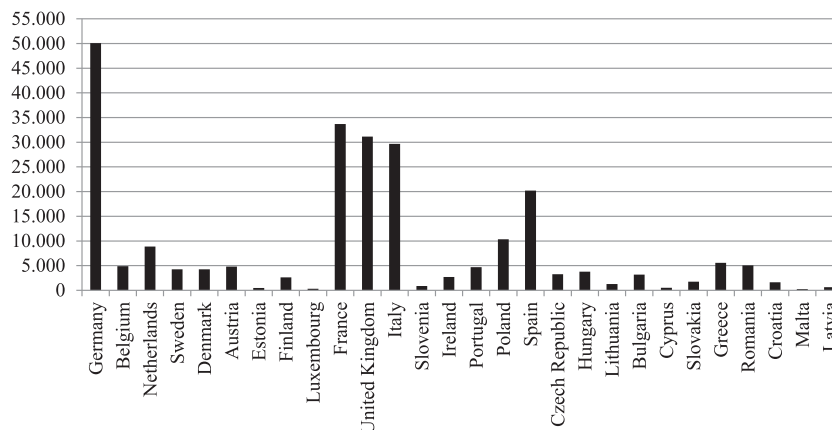


Fig. 1. Municipal waste generation by country, in thousand tonnes per year, data for 2014. (Note: 2013 data instead of 2014 for Ireland, Greece and Romania; position of single countries in Figure according to the groups defined – see Fig. 3) (Eurostat, 2016b).

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