Annex I: Analysis of evidences

List of graphs and tables

List of Abbreviations

ART	Zweckverband Abfallwirtschaft im Raum Trier
C&D	construction and demolition (waste)
CoR	Committee of the Regions
EC	European Commission
ELV	end-of-life vehicles
ESPON	European Observation Network for Territorial Development and Cohesion
EU	European Union
EU27	European Union of 27 Member States
EU28	European Union of 28 Member States (since 01.07.2013)
HH	household(s)
MBT	mechanical biological treatment
MSW	municipal solid waste
MW	municipal waste
PAYT	pay as you throw
SMEs	small and medium sized enterprises
TIA	Territorial Impact Assessment
WEEE	waste from electrical and electronic equipment

1. Background, aim and scope of the file note and methodology for assessment

In 2011, total waste production in the EU amounted to 2.5 million tonnes. From this total only a limited share (40%) was recycled, with the rest being landfilled (37%) or incinerated (23%) of which around 500 million tons could be recycled or reused according to estimates by the European Commission.

The limitations of waste management systems are reflected in many missed opportunities concerning jobs creation and growth, reduction of greenhouse gas emissions, and dependency on imported raw materials. Member States vary in implementing proper waste management measures. In 2011, 6 Member States landfilled less than 3% of their municipal waste, 18 landfilled over 50% of their municipal waste, with some further Member States sending more than 90% of their municipal waste to landfill.

Thus, further efforts are needed in the EU to improve waste management, with the objectives to improve resource efficiency, reduce consumption of primary materials and reduce the environmental impact of the European economy by means of waste prevention and the further introduction of a circular economy.

In this framework the European Commission (EC) is proposing the revision of targets of the different waste directives, in a Communication on Circular Economy released in June 2014, in order to establish mid-term waste targets in line with **EU ambitions** regarding **resource efficiency** and access to **raw materials**, as also recognized in the European Commission's Roadmap to a Resource Efficient Europe COM(2011) 571.

In particular, with the general objective to move towards an economy based on reuse, recycling and getting figures of residual waste close to zero, the existing prevention, targets from the Waste Framework Directive, the Landfill Directive and the Packaging and Packaging Waste Directive have been revised as part of a proposal to turn Europe into a more circular economy and boost recycling in the Member States (Communication on Circular Economy, 2nd July 2014[1]).

The review of waste targets has been supported by several stakeholder consultations and impact assessments. In particular, the "Proposal for reviewing

[1] COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN COMMISSION; PARLIAMENT; THE COUNCIL;THE EUROPEAN AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS – "Towards a circular economy: a zero waste programme for Europe", DRAFT, Brussels 2014.

the European waste management targets" and the "Executive Summary of the Impact Assessment"[2] identify and assess the key measures to be adopted in the new legislation. These concern in particular: the options needed to simplify the EU waste legislation for an easier and more homogenous implementation in Member States, the improvement of monitoring of waste management and identification of possible implementation problems, and the diffusion of optimal waste management in all Member States by promoting dissemination of best practices and key instruments.

In reviewing the EU waste targets, the Commission assessed several options and proposed a combination of measures which include: **simplification, improved monitoring, and diffusion of best practices** (including the alignment of definitions of key concepts as 'recycling' and 'reuse,' the removal of obsolete requirements, simplification of measurement methods and reporting obligations, creation of national registries on waste collection and management and verification of key data and statistics, introduction of an early warning procedure to monitor Member States performance and establishment of minimum conditions for the operation of EPR schemes), and a number of waste revised targets on reuse and recycling of municipal solid waste, packaging and landfilling. The proposed operational objectives reflect the ambitions set out in the EU's 7th Environmental Action Program (7th EAP):

- Waste generation should decline and be decoupled from GDP evolution;
- Reuse and recycling should be feasible at the highest level;
- Incineration should be limited to waste which is not recyclable;
- Landfilling of recoverable waste should be phased out;
- Marine litter should be significantly reduced.

In the final communication COM(2014) 397, the following measures are proposed to repeal what stated in the waste Directives:[3]

- Recycling and preparing for re-use of municipal waste to be increased to 70 % by 2030;

[2] European Commission: COMMISSION STAFF WORKING DOCUMENT EXECUTIVE SUMMARY OF THE IMPACT ASSESSMENT Accompanying the document Proposal for a Directive of the European Parliament and of the Council reviewing the targets in Directives 2008/98/EC on waste, 94/62/EC on packaging and packaging waste, and 1999/31/EC on the landfill of waste, amending Directives 2000/53/EC on end-of-life vehicles, 2006/66/EC on batteries and accumulators and waste batteries and accumulators, and 2012/19/EU on waste electrical and electronic equipment Brussels, 2.7.2014 SWD(2014) 208 final.

3 European Commission: Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directives 2008/98/EC on waste, 94/62/EC on packaging and packaging waste, 1999/31/EC on the landfill of waste, 2000/53/EC on end-of-life vehicles, 2006/66/EC on batteries and accumulators and waste batteries and accumulators, and 2012/19/EU on waste electrical and electronic equipment (Text with EEA relevance), Brussels, Brussels, 2.7.2014 COM(2014) 397 final 2014/0201 (COD).

- Recycling and preparing for re-use of packaging waste to be increased to 80 % by 2030, with material-specific targets set to gradually increase between 2020 and 2030 (to reach 90 % for paper by 2025, 60% for plastics, 80% for wood, and 90% for ferrous metal, aluminum and glass by the end of 2030);
- Phasing out landfilling by 2025 for recyclable (including plastics, paper, metals, glass and bio-waste) waste in non-hazardous waste landfills – corresponding to a maximum landfilling rate of 25%;
- Measures aimed at reducing food waste generation by 30 % by 2025;
- Introducing an early warning system to anticipate and avoid possible compliance difficulties in Member States;
- Promoting the dissemination of best practices in all Member States, such as better use of economic instruments (e.g. landfill/incineration taxes, pay-as-you-throw schemes, incentives for municipalities) and improved separate collection;
- Improving traceability of hazardous waste;
- Increasing the cost-effectiveness of Extended Producer Responsibility schemes by defining minimum conditions for their operation;
- Simplifying reporting obligations and alleviating burdens faced by SMEs;
- Improving the reliability of key statistics through harmonised and streamlined calculation of targets;
- Improving the overall coherence of waste legislation by aligning definitions and removing obsolete legal requirements.

This combination is expected to bring several benefits: administrative burden reduction (in particular for SMEs), simplification and better implementation, expected creation of more than 180,000 direct jobs by 2030 (most of them impossible to delocalize outside the EU), reduction of greenhouse gas emission (avoidance of 443 millions of tons could be expected between 2014 and 2030), re-injection of secondary raw materials in the economy (contributing between 10% and 40%, depending of the material, of the EU total raw material demand), positive effects on the competitiveness of the EU waste management and recycling sectors as well as in the EU manufacturing sector (better EPR, reduced risks in terms of raw material access and prices), and finally marine litter levels to be 7% lower by 2020, and by 24% lower by 2030.

This file note aims at contributing to the content preparation of the Territorial Impact Assessment workshop on the Commission´s Communication on Circular Economy, based on ESPON´s Quick Scan methodology planned for 9 September 2014.

Methodology

Evidence as to on the actual state of implementation of the EU Directives in Member States, as well as on possible impacts and effects, was collected for analysis. For a quantitative assessment of Member States performances, the following actual and proposed EU targets were used for benchmarking with available data. With respect to methodology this file note was exclusively based on desk-based research and relies completely on existing published information and evidences. Due to a limited time frame and financial budget no new survey or data gathering was possible.

Table 1: Comparison of old EU directives waste targets, recently proposed targets and CoR outlook opinion

Old directives	**New proposal (COM(2014) 397 final)[4]**
Landfill [5]	
2016: 35% of biodegradable municipal waste within Member States (some may postpone the attainment of targets up to 4 years).	2025: not more than **25%** (ban of recyclable waste incl. plastic, metals, glass, paper and cardboard and other biodegradable waste)
Re-use and Recycling of municipal and C&D waste[6]	
2020: 50% (paper, metal, plastic and glass) 70% reuse, recycling and other recovery (incl. backfilling) of construction and demolition waste	2030: 70% all municipal waste (2c)
Packaging and packaging waste[7]	
2008: min 55 % and max 80 % of packaging waste will be recycled. The following minimum recycling targets for materials contained in packaging waste will be attained: ➢ 60 % by weight for glass; ➢ 60 % by weight for paper and board; ➢ 50 % by weight for metals; ➢ 22,5 % by weight for plastics, counting exclusively material that is recycled back into plastics; ➢ 15 % by weight for wood.	2020: min 60% 2025: min 70% • 60% plastic • 65% wood • 80% ferrous metal • 80% aluminum • 80% glass • 90% paper and cardboard 2030: min 80% all

[4] European Commission (2014c): Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directives 2008/98/EC on waste, 94/62/EC on packaging and packaging waste, 1999/31/EC on the landfill of waste, 2000/53/EC on end-of-life vehicles, 2006/66/EC on batteries and accumulators and waste batteries and accumulators, and 2012/19/EU on waste electrical and electronic equipment (Text with EEA relevance), Brussels, Brussels, 2.7.2014 COM(2014) 397 final 2014/0201 (COD).

[5] European Commission (1999) Council Directive 1999/31/EC of 26 April 1999 on the Landfill of Waste.

[6] European Commission (2008) Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on Waste and repealing certain Directives, Brussels 2008.

[7] European Commission (1994) European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste.

2. Evidences

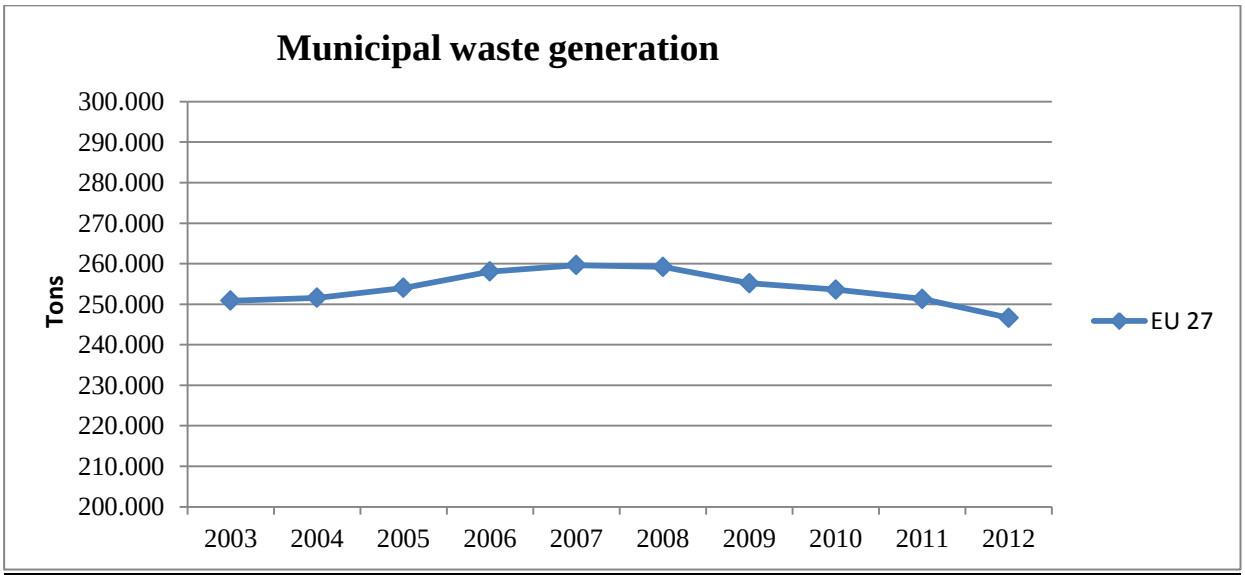
2.1 Evidences from the implementation of current waste legislation

2.1.1. Status of the implementation of current waste legislation and reported difficulties in the implementation of EU waste targets

The EU legislation of the last two decades has certainly provided the driving force for better waste management in EU member countries, and the comparison of the landfilling and recycling rates across Europe highlights the importance of proper implementation of national and regional instruments for waste management.

As a starting point, general evidence concerning waste generation in the EU can help in framing the problem.

Municipal waste generation in the EU has remained stable in the past decade, as shown in **Graph 1**, with a slight decrease after 2008 probably due to the economic crisis. In spite of all established recycling targets, the EU has just adopted its first waste prevention target, namely a 30% reduction of food waste. The EU is nevertheless understanding the importance of avoidance of waste at the source, and now requires Member States to establish national **waste prevention programmes** by 12 December 2013, which shall be revaluated at least every sixth year.



Graph 1: Waste generation in the EU 27 from 2003 to 2012. Source: Eurostat 2012

Recent evaluation of the state of implementation of current waste legislation within Member States (EEA 2013), indicates that generally there have been substantial increases in the past two decades in the proportion of municipal waste recycled, and a shift away from landfilling towards preferred waste management approaches. Nevertheless, the majority of EU countries still landfilled more than half of their municipal waste in 2010, providing evidence that further efforts are needed to change the waste hierarchy.

In this framework, there is evidence (within regional recycling data) that there is substantial variation between different regions, indicating that regional and local policies have a significant influence on municipal waste recycling rates.

This first session aims at presenting the state of implementation of EU waste recycling targets with regard to MSW, C&D waste, biowaste to landfill and packaging waste. The targets are presented separately.

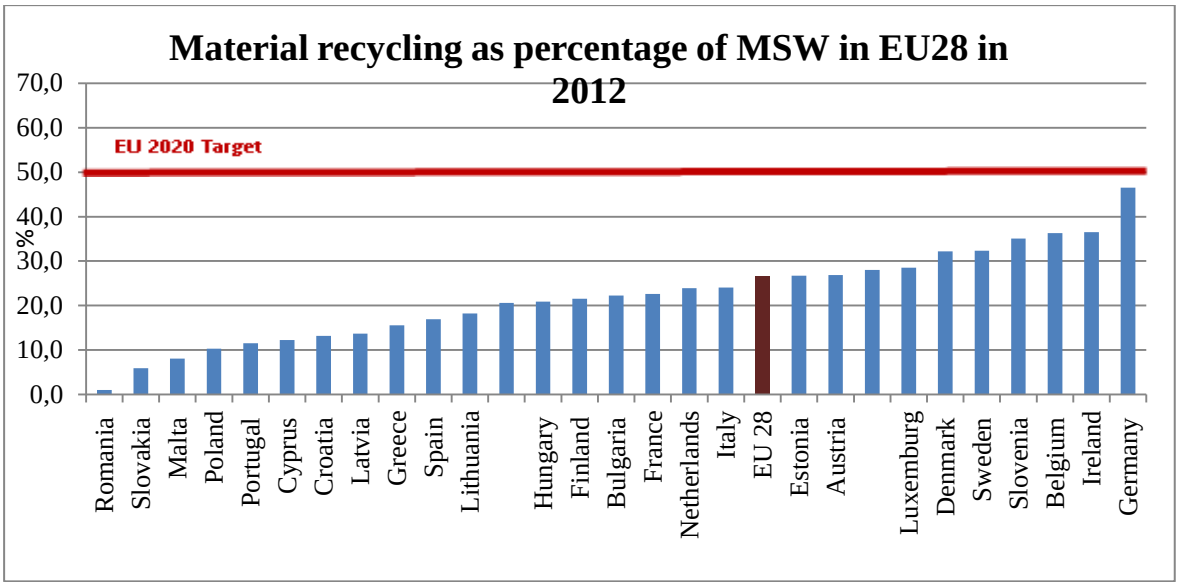
2.1.1.1 *Waste Framework Directive 2008/98/EC*

Recycling rates of Municipal Solid Waste

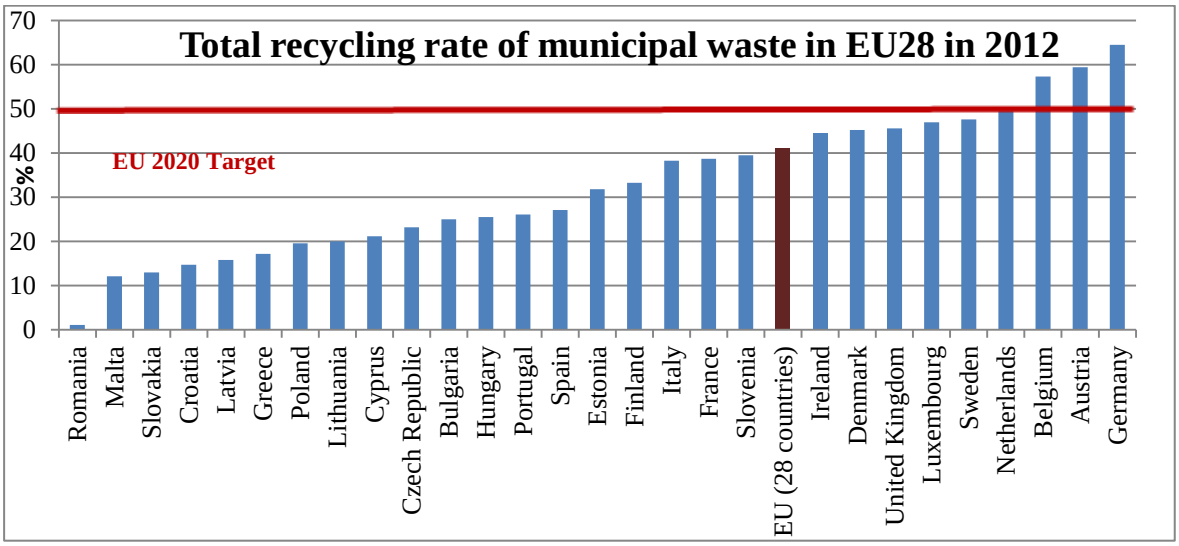
Based on Eurostat data, recycling rates for municipal waste can be calculated in two different ways - by including composting and biowaste (total recycling, see Graph 2) or considering just total material recovered. Thus, total recycling includes material recycling as well as composting and digestion of bio-waste.

As reported by the EEA, the progress observed in the past decade in recycling rates is primarily due to trends in recycling of materials, especially glass, paper and cardboard, metals, plastic and textile, while over the same period of time bio-waste recycling performed less well.

A direct analysis of the most recently available Eurostat data on total material recycling (as a percentage of MSW), provides evidence that no Member State has been able to reach the target of 50% set by the Directive. In the EU in 2012, about 27% of all generated Municipal Solid Waste was recycled (thus excluding incineration and energy recovery, and landfilling). The same calculation performed by including composting and material digestion shows a slightly different picture, with 3 countries having already achieved the EU target of 50% in 2012.



Graph 2: Share of material recycling in the treatment of municipal solid waste in the 28 EU Member States in the year 2012 (data from Eurostat 2014)



Graph 3: Recycling rates of MSW – 2012 in EU Member states, including material recycling, composting and anaerobic digestion. [8]

[8] Recycling includes. Municipal waste consists to a large extent of waste generated by households, but may also include similar wastes generated by small businesses and public institutions and collected by the municipality; this latter part of municipal waste may vary from municipality to municipality and from country to country, depending on the local waste management system. This variation in scope across the Member States means that cross-country comparison is problematic. For areas not covered by a municipal waste collection scheme the amount of waste generated is estimated. The Member states report each year the amount recycled and the total municipal waste generated to Eurostat. (i) More information can be found here: Http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Municipal_waste_statistics.

→Difficulties and inconsistencies in the implementation of the target:

Although a significant improvement in recycling performance was observed in the past two decades in many Member States, the numbers still show enormous differences in performance between those countries with the lowest recycling levels and those with the highest.

This is caused by different factors: e.g. length of time the country had been a Member State. For new member States their municipal waste management systems (based on EU requirements) might still be in their infancy. For older Member States with a longer experience with waste management, further improvements are likely to be much more challenging, as this can include technical limits for recycling, high costs for recycling products or materials not designed for recycling, and competition with waste incineration capacity.

Last but not least, one pre-requisite for achieving the targets of the Waste Framework Directive is that municipal waste collection achieves full waste collection coverage. According to the latest Eurostat data (2014), in 2011 from 93 reporting regions 23 regions did not yet achieve full coverage of municipal waste collection. The lowest regional coverage of waste collection reported for the year 2011 was 64 %. These underperforming regions are situated in Hungary and Poland. In addition Estonia and Lithuania reported that not all of their territories were covered by municipal waste collection. Five further EU countries might have also not yet have achieved full coverage of municipal waste collection (Bulgaria, Croatia, Greece, Latvia, Romania), but this cannot be confirmed as data is missing.

The analysis of past performance and trends provides indications as to the potential of Member States to achieve the target of 50% municipal waste recycling target by 2020. Here, the outlook is not optimistic - just 4 countries have already achieved the target and another 5 were able to recycle between 40 and 50% of their municipal solid waste; whilst the majority of countries with recycling targets below 40% will need to make an extraordinary effort in order to achieve the target of 50 % recycling by 2020, and the 70% target by 2025

2.1.1.2 *C&D waste targets*

Construction waste is defined as waste originating from new constructions, and differs from demolition waste in terms of recovery potential, due to the lower potential for contamination and impurity. Therefore, construction waste represents a lower share of C&D waste. Some Member States used to include in the reporting requirements excavation materials, generating incomparability of

data between different countries, thus current data on C&D waste does not allow for a completely accurate estimate of the total quantities generated in Europe.

In a recent study on C&D waste commissioned by DG ENVIRONMENT (Biois, 2011), data on generation and recycling rates of C&D were calculated and are shown in Table 2.

Table 2: Calculation of the average recycling rate of C&D waste (BIOIS, based on own assumption and data reported by ECT/ RWM 2009 and UBA 2008, or individual estimation. Source: Bio Intelligence Service, 2011

Country	Arising (million tonnes)	% Re-used or recycled
Austria	6.6	60
Belgium	11.02	68
Bulgaria	7.8*	0**
Cyprus	0.73*	1
Czech Republic	14.7*	23
Denmark	5.27*	94
Estonia	1.51	92
Finland	5.21*	26
France	85.65*	45
Germany	72.4*	86
Greece	11.04*	5***
Hungary	10.12*	16
Ireland	2.5*	80
Italy	46.31	0**
Latvia	2.32*	46
Lithuania	3.45*	60
Luxembourg	0.67*	46***
Malta	0.8	0**
Netherlands	23.9	98
Poland	38.19*	28
Portugal	11.42	5***
Romania	21.71*	0**
Slovakia	5.38*	0**
Slovenia	2*	53***
Spain	31.34	14
Sweden	10.23	0**
United Kingdom	99.1	75
EU27	531.38	46
Legend: ***UBA 2009 **No data available: worst case scenario assumed *Reminder: data from ETC/RWM 2009 corrected to exclude excavated material and fill data gaps		

According to the above data, 6 Member States (generating 39% of total C&D Waste in EU) already achieved the target of 70% recycling, with Belgium already closed to the 2020 target with 68% recycling already in 2009.

The average of 46% recycling rate for EU 27 is a broad estimation with a huge uncertainty. However, it looks rather plausible that the range of estimates proposed by experts and literature varies from 30 to 60%.

At national level, the current situation is as follow:

→6 countries report recycling rates that already fulfill the Directive´s target (Denmark, Estonia, Germany, Ireland, the UK and the Netherlands)

→3 countries report recycling rates between 60% and 70% (Austria, Belgium and Lithuania)

→4 countries (France, Latvia, Luxemburg and Slovenia) report recycling rates between 40 % and 60%

→8 countries report recycling rates lower than 40% (Cyprus, Czech Republic, Finland, Greece, Hungary, Poland, Portugal and Spain)

→For 6 countries, no data was available to estimate the recycling rates (Bulgaria, Italy, Malta, Romania, Slovakia and Sweden).

With regard to the implementation of the target into national policies, Member States are still in the process of integrating the 70% goal into their national legislation, although it is difficult to assess how this will be implemented in practice.

The actual impact of the target depends also on the current recycling rates achieved by different MS. As already said for MSW recycling, it will be rather challenging for countries with actual low recycling rates to reach the 70% recycling target within the given time, and to catch up with MS already having a longer tradition concerning C&D waste recycling.

Finally, the correlation coefficient C between waste generated and estimated recycling of C&D was calculated. C is relatively low (C=0,18). When the calculation is performed excluding the estimated data (e.g. worst case scenario assumed), C is even lower (C=0,17). Therefore it can be concluded that there is no correlation between the amount of C&D waste generated in EU countries and the potential to recycle C&D waste (or in other words, that countries producing the biggest amounts of C&D waste are not necessarily those that will recycle more). Nevertheless, it has to be noted that no revised targets for C&D Waste have been proposed in the Communication on Circular Economy.

Difficulties and inconsistencies in the implementation of the target:

A variety of difficulties and inconsistencies were identified with regard to the implementation of C&D targets:

Architectural habits can influence the quality of C&D waste and preferable treatment methods. E.g. it was reported that in Finland, demolition waste accounts for 40% of wood waste. The Finnish national target, set at 70% by 2016, includes energy recovery: thus, reaching 70% of recycling can be a problem for such countries.

Lack of standards for C&D waste and recycled materials: The promotion of recycled material from C&D waste was identified as one of the key drivers to achieve higher recycling rates from C&D waste; however, few building standards exist setting quotes of recycled material for new construction, specific requirements for waste management on new building construction sites, or during the dismantling and demolition of the building. It has to be evidenced that some countries are doing already considerable efforts to implement such standards into their waste legislation. E.g., in Flanders the waste framework policy sets mandatory conditions for the use of secondary raw materials in construction; in Germany: a draft "Ordinance on substitute construction material" will determine the conditions for harmless used of recovered excavation material and waste; in Finland, the "Government Decree on the Recovery of certain wastes in earth construction (591/2006) promotes the recycling of waste in some construction activities such as road, and public soil.

Inconsistencies with the Landfill Directive: As highlight by The Fédération Internationale du Recyclage (*FIR*) in a series of communications to DG ENVIRONMENT, the production and sales of recycled aggregates has shown only to be possible when proper waste management is in place. The valuable raw material, in this case inert C&D waste, is disposed of in illegal and legal landfills throughout Europe. As long as this is the case, the supply of sustainable recycled material will never take place. Similarly, the supply of recycled aggregates is frustrated by local and national practices, such as filling old quarries with C&DW (known as "backfilling operations") or spreading C&D Waste for "land cultivation".

In addition, Article 6 of Council Directive 1999/31/EC (Landfill Directive) states that MS shall take measures in order that … (a) only waste that has been subject to treatment is landfilled. This provision may not apply to inert waste for which treatment is not technically feasible, nor to any other waste for which treatment does not contribute to the objectives of this Directive".

For inert landfills, the provision is counterintuitive and wrong: when a company takes the effort to process C&D Waste to produce inert waste, this is typically cleaner, easily recyclable, and thus landfilling it makes no sense.

Taking account of the Waste Framework Directive (article 3 on Waste Hierarchy) one must conclude that such an act is actually illegal. If treatment of C&D Waste is not considered feasible, this means that sorting cannot take place. The waste is therefore still mixed waste, not inert. Therefore landfilling at an inert landfill should not be allowed.

Regional differences in landfilling taxes and uncontrolled landfilling: In some countries, such as Spain, the lack of control of unauthorised landfills and the high differences in landfill taxes between regions were identified as one of the main barriers to the recovery of C&D Waste.

Economic barriers: high availability and low cost of raw material: Large fractions of C&D waste are composed of minerals and aggregates which are abundant and easy to find and with low production costs: therefore, one of the main barriers to the implementation of recycling measures concerns the competition on the market with virgin raw material. Solution to this problem can be levies/bans on landfilling and taxes on resource extraction.

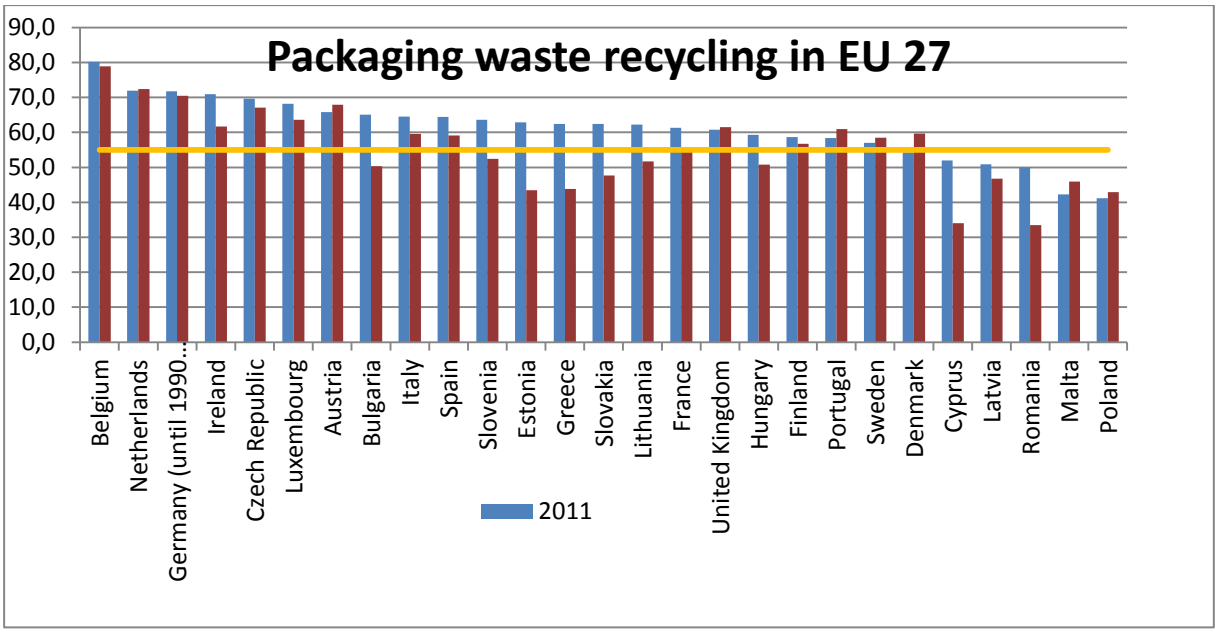
Ability of the market to absorb recyclates: Markets have a limited capacity to absorb recyclates from C&D waste, therefore it is not possible to reintroduce all recycled fraction in the life cycle.

Cultural barriers in the conception of the quality of recycled products: Recycled aggregates often suffer from consumers' misconceptions about their lack of reliability and their quality to be employed as new construction materials. These could be overcome especially by: the development of quality criteria, standards and certifications on secondary raw materials, development of end-of life criteria for waste materials, proper communication on benefits from secondary raw materials (in some case these present better properties than virgin materials, as in roads applications), stimulation of Green Public Procurement and mobilization of critical mass movements to demand for more sustainable construction materials.

Technical barriers: ineffective sorting and contamination of the waste flow: Secondary raw material needs to have a certain degree of purity in order to be cost-effective recycled. Contamination of waste should be avoided by encouraging proper waste sorting at the source, and selective or controlled demolition.

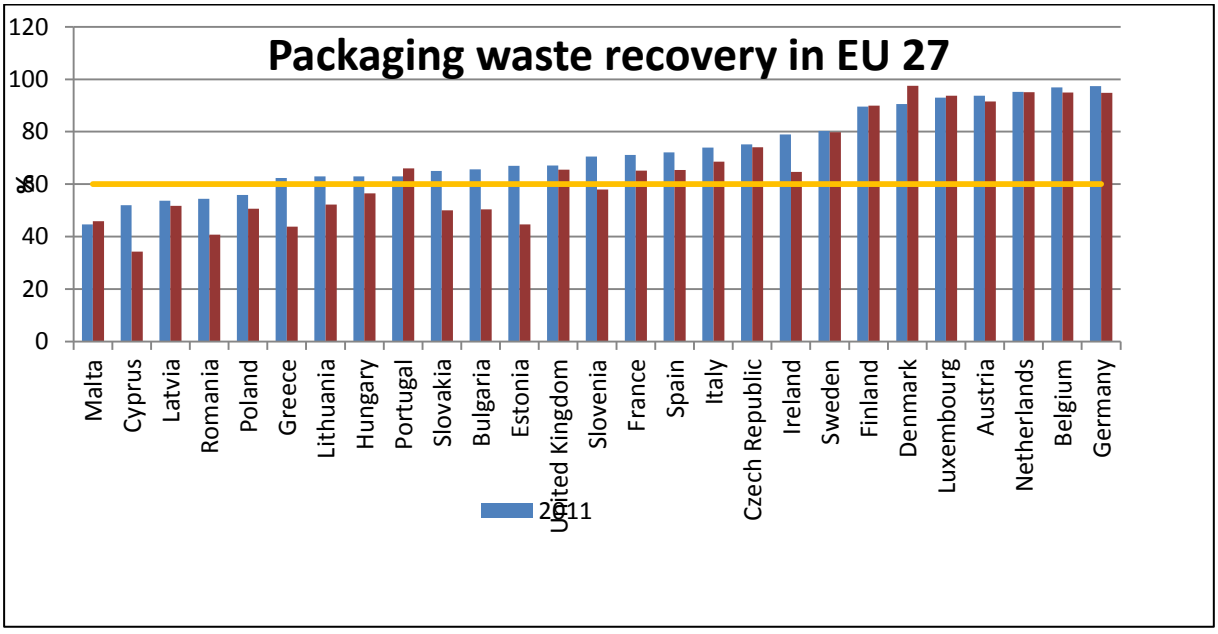
2.1.1.3 *Recycling and recovery of Packaging waste*

EU Member States performances in reaching the targets are shown in Graph 4: Packaging waste recycling in EU 27 countriesTwelve Member States were not able to reach the EU target of a minimum of 55% of packaging waste to be recycled by 31 Dec. 2008. Three years later, in 2011, just five Member States were below the EU target.



Graph 4: Packaging waste recycling in EU 27 countries in 2008 and 2011, benchmarked against the target set by the Packaging Directive. (Source: Eurostat 2014)

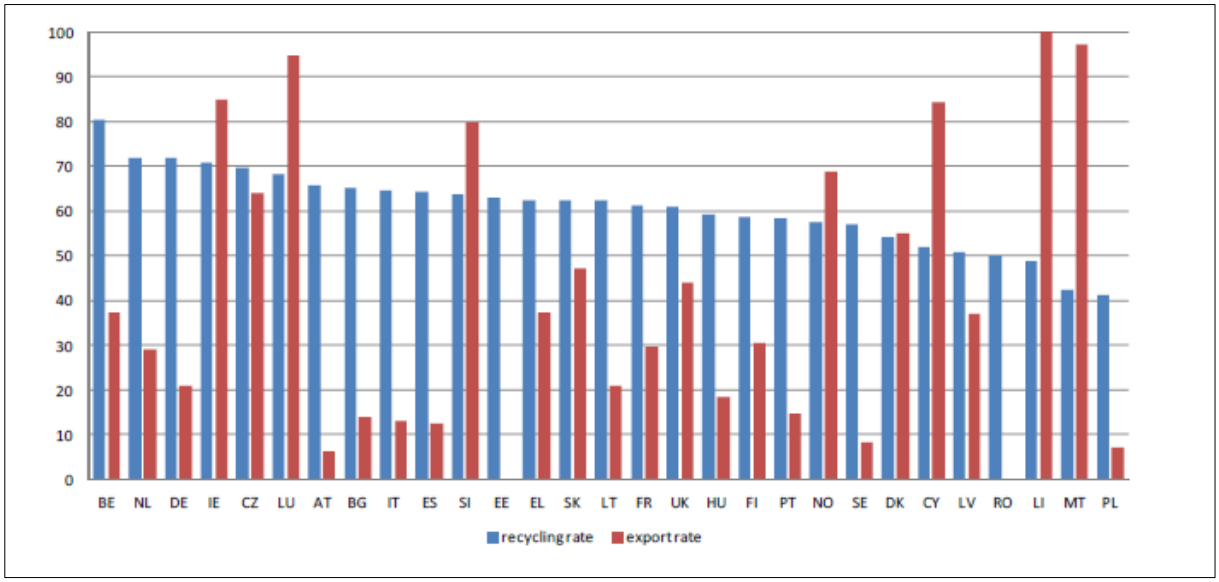
Concerning recovery of packaging waste, four Member States are still failing to reach the targets set for 2008.



Graph 5: Rate of recovery or incineration at waste incineration plants with energy recovery in EU in 2008 and 2011. [9]

[9] for the purposes of Article 6(1) of Directive 94/62/EC means the total quantity of packaging waste recovered or incinerated at waste incineration plants with energy recovery, divided by the total quantity of generated packaging waste . Source: http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&plugin=1&language=en&pcode=ten00062.

Waste can be transported abroad if there is a lack of recycling capacities. In the case of packaging waste, this is evidence in Graph 6, showing seven Member States which report waste export rates higher than domestic packaging recycling:[10]



Graph 6: Overall packaging waste, recycling and export rates by Member State, 2011

It could, therefore, be argued that in these seven countries, new targets on packaging waste could result in a further increase in waste shipment/ transportation.

Recycling rates by packaging waste type

Graph 7 shows the packaging waste recycling rates for a number of different packaging types: paper/cardboard, plastic, wooden packaging, metallic packaging and glass for the 2 EU Member States with the highest packaging waste recycling rates (Belgium and Germany), the average of the European Union (EU27) and for the 2 EU Member States with the lowest packaging waste recycling rates (Malta and Poland). Also shown in Graph 7 are the recycling targets set by the Packaging Waste Directive.

With respect to paper/cardboard all countries shown have achieved high recycling rates. The EU average is already 83 %.

With plastic packaging the recycling rates are much lower, 34 % is the EU average. This may reflect the difficulties with keeping the different plastic types

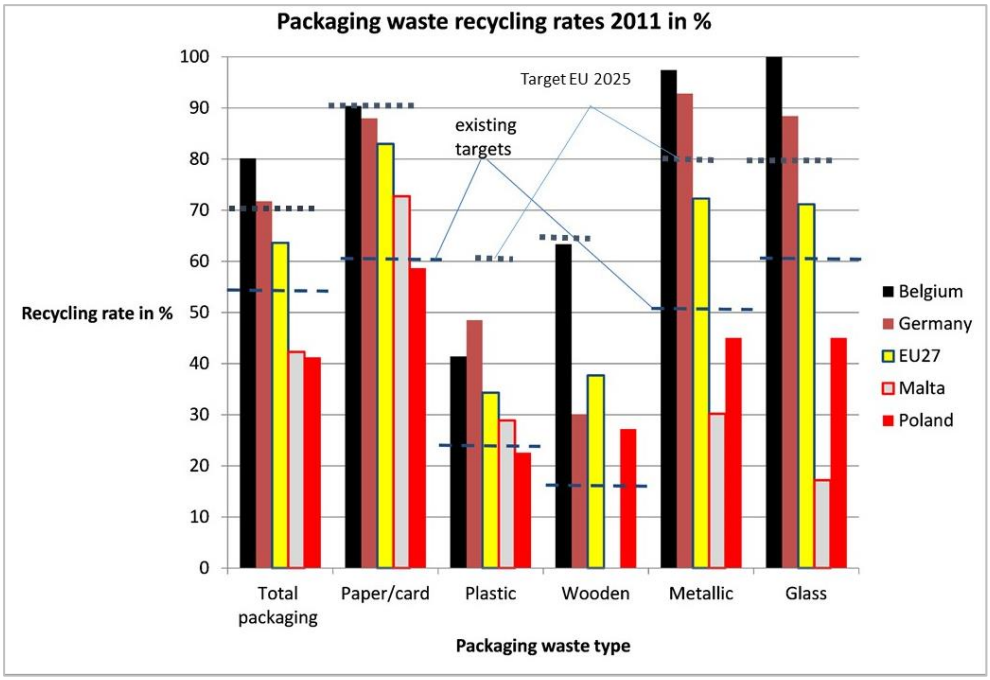
[10] Source: EUROPEAN COMMISSION: Ex-post evaluation of Five Waste Stream Directives on Eurostat data, 2013.

separate and with establishing the markets for the material recycling of the different plastic types. It also needs to be mentioned, that the majority of the waste plastic collected in the EU is not recycled within the EU but exported to China and Hong Kong (BioIS 2011a).

With respect to the recycling of wooden packaging waste there are substantial differences between the countries (see Graph 7), ranging from 63% in Belgium to 0% in Malta. The recycling rates for metallic and glass packaging are much higher than with wooden packaging. The differences between the countries, however, are also big, ranging from 97 to 30% for metallic packaging and from 100% to 17% for glass packaging in Belgium and Malta, respectively.

While not all countries had achieved the recycling targets for wooden, metallic and glass packaging by 2011, the achieved EU-averages lie well above the targets for all packaging waste types (see Graph 7).

One note needs to be added to the Belgium metallic and glass packaging recycling data. Recycling rates in terms of metals/glass recycled from used packaging over total packaging metals/glass put on the market beyond 95% seem almost impossible. Even in a perfect system there must be some dissipation during use, collection and treatment. Also a look at the streets and of the public separate waste collection system of Bruxelles reveals, that the losses of metallic beverage cans to littering and allocation to residual waste and wrong waste fractions seem to be as pronounced in Bruxelles as in other middle European towns. Therefore there is reason for doubt that the extremely high recycling rates reported by Belgium fully correspond to reality.



Graph 7: Packaging waste recycling rates by packaging types in 4 selected EU Member States and the EU27-average for the year 2011

Difficulties and inconsistencies in the implementation of the old and revised targets:

The EU as a whole seems to perform well in terms of total recycled packaging, although some difficulties in the implementation of singular targets could be evidenced, as could a lack of market demand for recyclates and the technical limitations of the recycling process (e.g. in the case of paper, recycling cannot exceed a certain amount of cycles, whilst in the case of certain types of plastic, recycling technologies are still limited.

2.1.1.4 *Landfilling and landfill diversion of biowaste*

Landfilling

Current waste legislation places limitations on the total amount of biowaste going to landfill, but not on waste landfilling itself. The application of a new target of 25% of maximum waste going to landfill has been recently proposed by the European Commission in its Communication on Moving Towards a Circular Economy. For a wider analysis on past and future targets, data on both landfilling and biowaste to landfill are presented.

Landfilling trends in EU28 are presented in Graph 8. This graph shows landfilled waste in Member States in three different years, namely in 2006, 2009 and 2012. It demonstrates on one side a group of 6 Member States which can be characterized by well-established waste management systems and which in the

previous 10 years have are already achieved landfilling of less than 5% of their MSW; on the opposite side, there is another group of 8 Member States that have never managed to landfill below 80% of their MSW. All other Member State show good progress concerning reduction of MSW to landfill, but more than half of Member States still landfill more than 50% of produced waste.

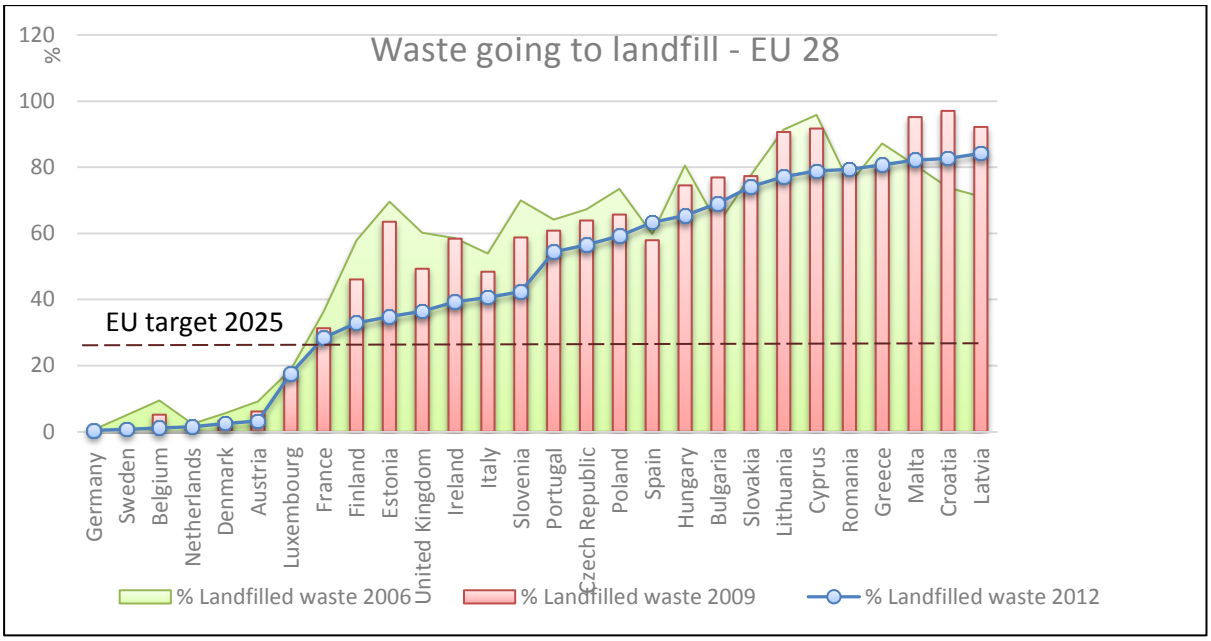
Data were further analysed according to two different periods, namely in 2003-2007 and 2008-2012.

EU 27 performance in avoiding landfilling of waste slightly improved in the period 2008 – 2012: producing fairly the same amount of waste as in the period 2003 – 2007 (with a reduction in 5 years of about 8240 Tons of waste) it was able to send 8% less waste to landfill.

Table 3: EU performance in decreasing waste to landfill (Source: Eurostat database)

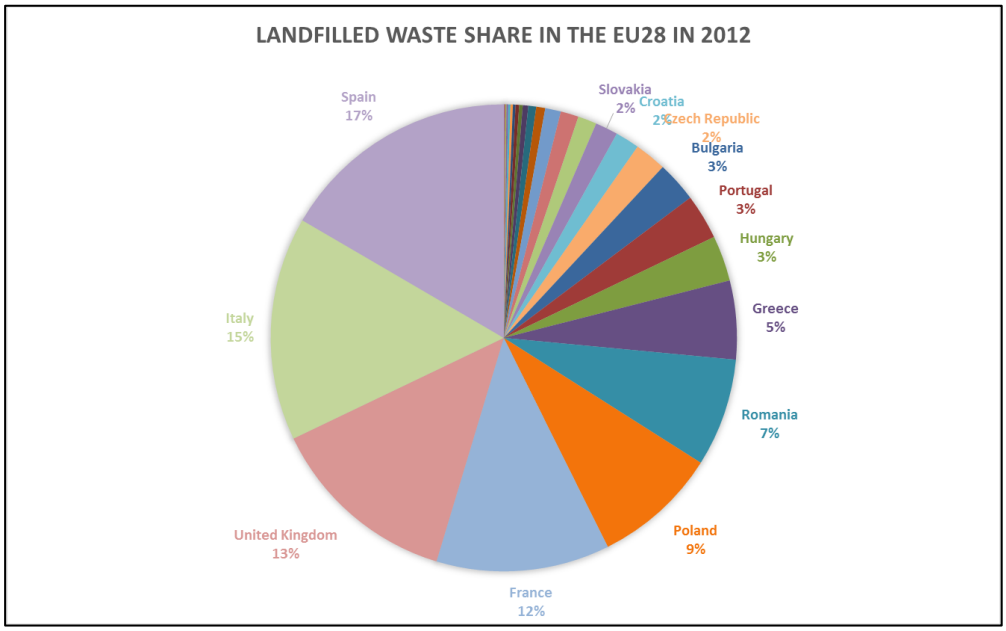
EU 27 performance in decreasing waste to landfill	Year 2003-2007	Year 2008 – 2012	Difference
Total MSW generated within EU 27 (Thousands of tonnes)	1,274,137	1,265,896	8241
Total MSW going to landfill in EU 27 (Thousands of Tonnes)	564,745	456,089	-108,656
Total MSW going to landfill (%)	44.3	36.02	-8%

In conclusion, it can be argued that at least half of the EU countries are making good progress in meeting the EU objective on diverting waste from landfill. The target of 25% has already been met by 7 Member States (e.g. Germany, Sweden, Belgium, Netherlands, Denmark, Austria and Luxembourg), while other 7 Member States show a positive trend in diverting waste from landfill (e.g. France, Finland, Estonia, United Kingdom, Ireland, Italy and Slovenia). Still, the target seems far from realistic for the other Member States, and especially for 11 countries still landfilling more than 60% of their waste. Anyway, as the EEA reports demonstrate, the introduction of a landfilling ban and taxes seem to have a good impact on increasing recycling in various Member States.



Graph 8: Waste going to landfill in 2006- 2009 and 2012- Based on Eurostat data 2014

However, the data (in terms of percentages) could in some cases give a distorted perception of reality. Graph 9 for example, demonstrates that about ¾ of landfilled waste in the EU, is in reality landfilled by just 6 Member States. Thus, particular effort might be focussed on reducing landfill in these countries.



Graph 9: Share of landfilled waste per Member State in 2012.

Landfilling and diversion of biowaste

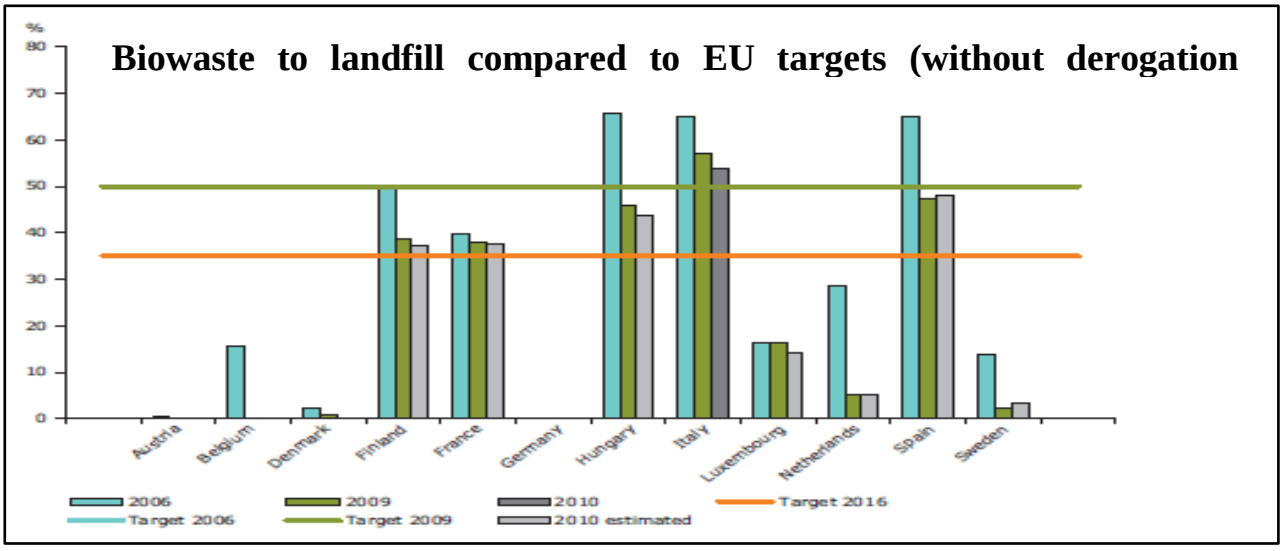
The two graphs below (EEA, 2013) show the performance of Member States (with and without reliance upon the derogation period), in diverting biowaste from landfilling compared to 1995.

Among countries without reliance upon the derogation period, seven had fulfilled the 50% target for 2009, with one country falling short of the target (based on estimated data). Seven countries had also already achieved the 2016 target of 35 % by 2010.

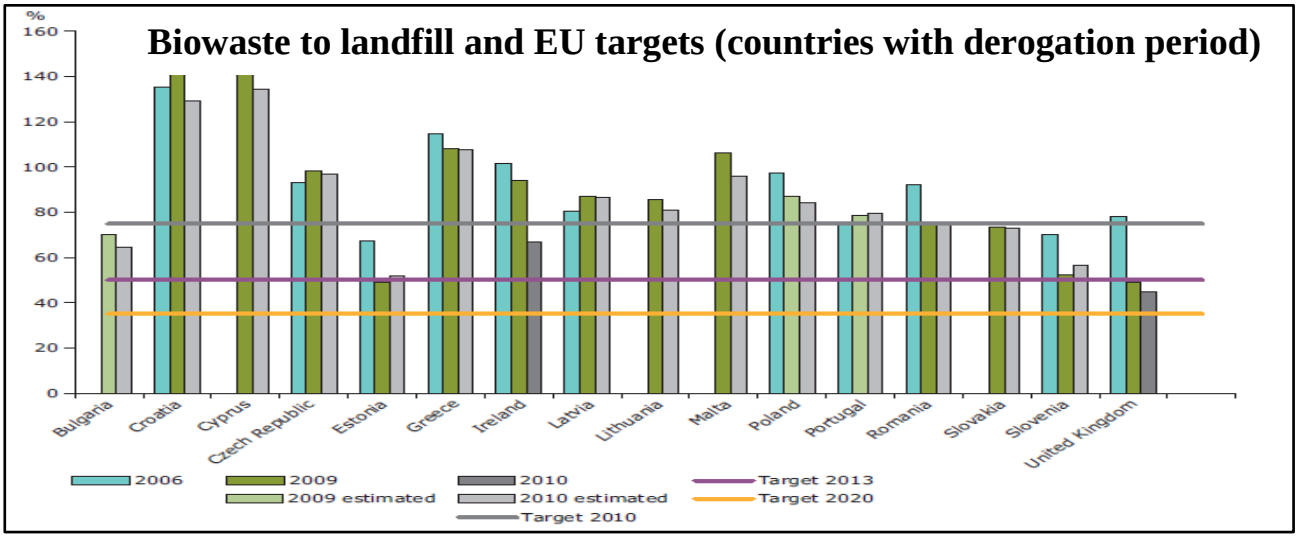
Among countries relying on the derogation period, more than half have been unable to achieve the 2010 target (which relates to absolute amounts of biodegradable municipal waste generated in 1995), showing low potential to move sufficient biodegradable waste from landfill, to recycling, or to develop sufficient capacity for incineration with energy recovery. There were also significant increases in the generation of municipal waste and consequently biodegradable municipal waste in some countries (such as Cyprus, the Czech Republic and Slovakia).

Many countries, including Estonia, Hungary, Ireland, Italy, Poland, Portugal, Spain and the United Kingdom, have managed to cut the percentage of biodegradable municipal waste landfilled markedly during the last four years and are gradually moving up the waste hierarchy from landfilling to other waste management measures.

The EEA considers that an incremental approach to target-setting seems to be a valuable approach in enabling biodegradable municipal waste landfill diversion, allowing for gradual progression, allowing improved waste management systems to be developed. (EEA, 2009).



Graph 10: Percentage of biodegradable municipal waste landfilled in 2006, 2009 and 2010 compared with the amount generated in 1995 for countries without derogation periods. (Source: EEA 2013)[11].



Graph 11: Percentage of biodegradable municipal waste landfilled in 2006, 2009 and 2010 compared with the amount generated in 1995 — countries with derogation periods. ([12]Source: EEA 2013)

Difficulties and inconsistencies in the implementation of the target:

EU rules only limit the amount of biodegradable waste that can be landfilled - it can therefore be argued that the absence of an EU-wide obligation to recycle bio-waste, the absence of common EU quality standards or end-of-waste criteria for generated compost/digestate, and the absence of limitations on total

[11] 2010 data are estimated for all countries but Italy, on data provided by EU Member States to the European Commission (EC, 2012a), ETC/SCP (2013d) and ETC/SCP estimates.

[12] Note: 2009 data are estimated for Bulgaria, Poland and Portugal. The 2010 data are estimated for all countries but Ireland and the United Kingdom. Diverting derogations: Ireland: derogation only for the 2006 and 2009 targets, to be met 2010 and 2013. Portugal: derogation only for the 2009 and 2016 targets, to be met in 2013 and 2020. Slovenia: derogation only for the 2016 target, to be met by 2020. Croatia must meet the targets by 2013, 2016 and 2020.

landfilled waste do not create the right conditions to oblige Member States to perform better.

In addition, a pre-requisite for achieving the targets of the Waste Frame work Directive is that municipal waste collection achieves full coverage. According to Eurostat data (2014), in 2011 from 93 reporting regions, 23 regions did not yet achieve full coverage of municipal waste collection. The lowest regional coverage rate reported for the year 2011 was 64%. These regions are situated in Hungary and Poland.

In addition Estonia and Lithuania reported that not all of their territories were covered by municipal waste collection. For the other 5 EU Member States which may not yet have achieved full coverage of municipal waste collection (Bulgaria, Croatia, Greece, Latvia, Romania) the 2011 data is missing. In addition, it can be argued that countries which have a 100%, or near 100%, landfilling share in municipal waste treatment, cannot yet have achieved the landfill diversion target.

2.1.1.1 *Difficulties in the implementation of recent EU Member States*

A report by ERNST&YOUNG (2011) analyses the state of implementation of municipal waste management in 11 EU countries, namely: Bulgaria, Czech Republic, Estonia, Greece, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia and Hungary. These Member States typically face similar challenges in managing municipal waste. Note that this report focuses on many of the Member States that joined the EU in 2004 (with exception of Greece, and leaving out from the analysis Malta, Cyprus and Croatia - the latter being not yet part of the EU at the time the report was published). In spite of the fact that the state of municipal waste management in EU-11 countries improves annually thanks to the implementation of the EU directives into national legislation and the steady rise in public awareness, the list of unsolved problems remains very long. These countries have implemented the majority of EU legislation regarding waste management, with an average degree of transposition in the EU-11 of 83%. In particular, full transposition (100%) was carried out by Lithuania, Latvia and Romania, while the lowest degree of transposition was carried out by Greece (65%) and Bulgaria (50%).

The analysis of the state of municipal waste management in the EU-11 identified 3[13] key issues faced by the selected countries:

[13] At the time the report from ERNST&YOUNG was written, a 4th key issue was reported – namely concerning Compliance with targets set for recovery and recycling of packaging waste, conducted on EUROSTAT data from 2008. The same analysis conducted on 2011 data, indicates that the majority of the EU-11 MS managed to

State of implementation of EU legislation to National legislation:

The majority of the selected 11 EU countries have not yet fully transposed the EU Directives into national legislation. In particular, beyond Latvia, Lithuania and Romania, all the other countries have only achieved partial or insufficient implementation:

→Partial implementation (countries that have not transposed Directive 2008/98/EC on waste) – Czech Republic, Poland, Estonia, Slovakia, Slovenia and Hungary.

→Implementation of only selected requirements – Bulgaria and Greece.

In particular, many of the implementation issues have been because of the waste prevention programmes, and the implementation of recycling and recovery targets for waste materials and construction and demolition waste (7 out of 11 MS). On a more positive note, recycling and recovery targets for packaging waste, the requirement to reduce the quantity of biodegradable municipal waste disposed in landfills, and regulations regarding landfill operations are fully transposed into national laws.

Ineffectiveness of collection systems, lack of proper waste management plans, reliance on landfilling, and the existence of illegal dumping practices:

All EU 11 countries struggle with ineffectiveness in respect to their collection systems, while around 11% of total waste generated is suspected to be illegally dumped in the environment, mainly due to the lack of legislation and low public awareness. In addition, the majority of municipal waste that is disposed in landfills is not pre-treated or stabilized (e.g. inert waste). The main challenges these Member States have to face in order to move away from landfilling and adopt more advanced waste management systems are due to:
(1) Low landfilling fees (on average landfilling is still the most cost effective method);
(2) Shortage of waste treatment plans (such as for sorting, composting, mechanical biological treatment, recovery, recycling, and thermal treatment);
(3) Delays in the implementation of waste management plans complying with the EU Directives (meaning that many investments are still at a planning stage);
(4) A lack of proper incineration treatment plants and difficulties to build them and upgrade from landfilling to waste recovery, mainly due to resistance from NGOs and residents, especially in their neighborhood (the so called "Not In My Backyard" syndrome);
(5) A lack of incentives to use energy from waste.

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increase the amount of treated packaging, and reach the 2008 recycling and recovery targets with exclusion of, Romania, Latvia, Poland, Malta and Cyprus.

Phased reduction of biodegradable waste disposed in landfills

Analysis of waste management in EU-11 countries suggests that the requirement to reduce the quantity of municipal biodegradable waste disposed in landfills presents the biggest challenge for these countries. In particular there are issues about their ability to reduce the quantity of biodegradable waste disposed in landfills by taking advantage of thermal treatment potential. It should be highlighted that failure to comply with EU targets regarding the phased reduction of biodegradable municipal waste disposed in landfills may result in enforcement action by the European Commission and that such a failure would be a breach of treaty obligations.

2.1.2. Are the difficulties in a country specific or region specific issues?

Evidence from data analysis shows that difficulties in implementing EU waste legislation is partly regional, partly country specific.

EEA analysis

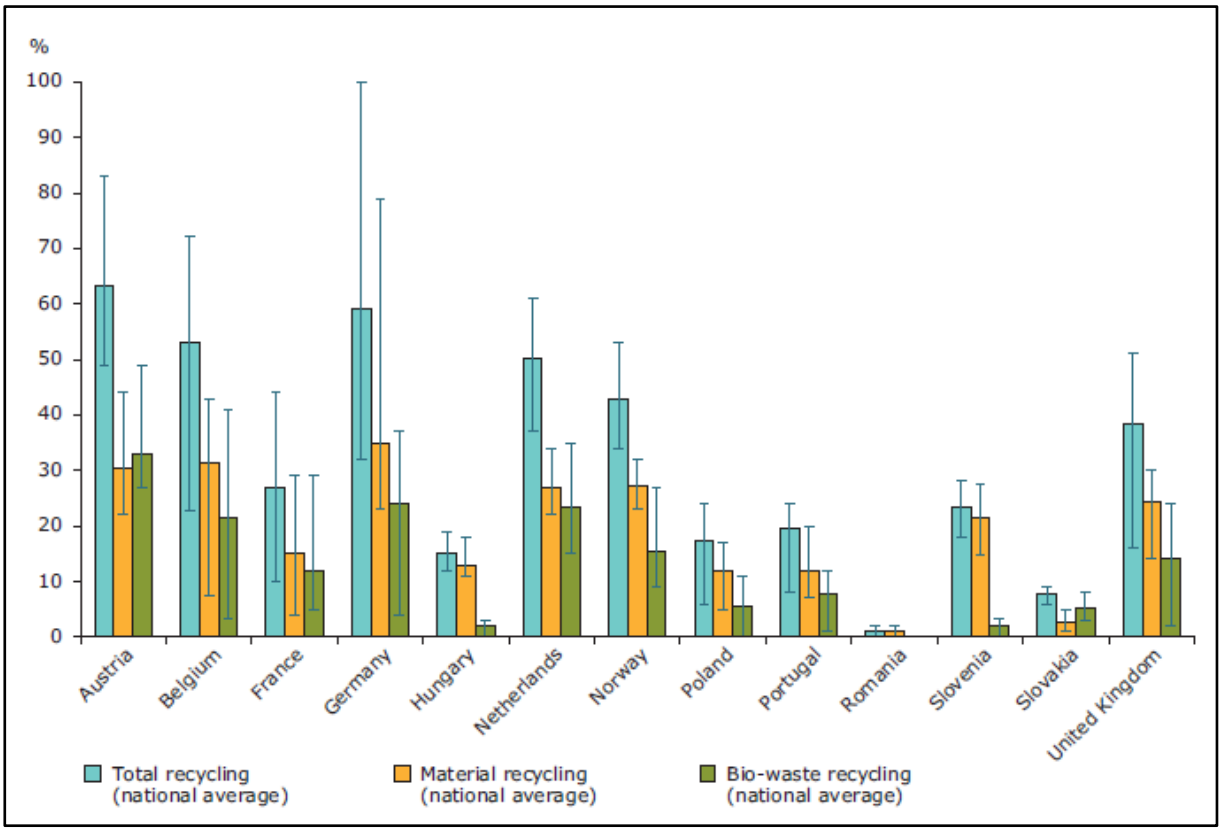
Analysis *conducted by the EEA on recycling of municipal waste for regions in 13 countries can be used to assess the regional differences in recycling levels in these countries.*

Graph 12 gives an overview on the variation of national material and bio-waste recycling rates for municipal waste, and the range between the regions in each country with the highest and lowest recycling rates. The variation in municipal waste recycling between a country's regions seems to be both due to variation in the recycling of materials and bio-waste.

The graph suggests that high national recycling rates are generally not reflected at regional level, where recycling rates can vary significantly (e.g. Austria, Belgium, Germany, and the UK), although differences in reporting various types of waste treatment can partially distort results.

EU and national targets are the overall drivers of better municipal waste, but regional policies and local implementation have a key role in the effectiveness of the waste management system. Some of the differences may, however, be influenced by differences in reporting. For example, one German region reports 100 % recycling, which presumably implies that it has reported all waste sent to sorting or mechanical biological treatment plants as recycled (although usually at least some part of the sorted waste is incinerated or landfilled). Other regions reports take into account the outputs of sorting and mechanical biological treatment.

Generally, regions with high recycling rates could serve as good practice examples and become knowledge-sharing platforms for other regions within countries, as well as for regional administrations across Europe.



Graph 12: Regional variation in municipal waste recycling rates including total recycling, material recycling and bio-waste recycling in 13 countries, 2008/2009[14]. Source: EEA from Eurostat data, 2012a.

Graph 12 shows regional differences in achieving recycling targets between Member States, based on data reported in Member States (EEA 2013). This data appears to show that territories respond differently to the implementation of the targets depending on their geographical characteristics: e.g. in rural area with high production of organic recycling, organic waste management systems are likely to be put in place to enable the recovery of organic matter (e.g. in some regions of The Netherlands and France). Conversely, implementing recycling systems may be economically and logistically problematic due to low density of the territory.

High density urban areas typically have lower recycling rates, often caused by a lack of space for containers and other infrastructure (e.g. as reported for Vienna,

[14] Note: The variation bar shows the highest and lowest regional recycling level within each country. 2008 data were used for Belgium, Germany, France, Hungary, Slovenia and Romania. 2009 data were used for the rest of the countries.

Paris, Brussels, and Inner London). These also have low organic waste recycling, as production is very limited.

Many low density urban areas seem to have a big potential to achieve recycling targets, due to a mixture of factors: the concentration of inhabitants in relatively small areas, the availability of space to implement proper collection and recycling systems, and the possibility to engage inhabitants in the sorting phase.

A report on Italian municipality achievements on recycling and waste reduction (Legambiente, 2014), found that 1328 municipalities (representing 13.7% of the Italian population) managed to achieve recycling rates of more than 65%. In general, municipalities with a number of inhabitants lower than 10,000 had a greater chance of achieving the 65% recycling targets, although positive results are generally reported for urban areas with populations between 1000 and 20,000 inhabitants, and in some more seldom cases also for high density urban areas such as Milan. Legambiente also found that in many municipalities it was possible to achieve very high levels of recycling – some achieved figures of over 80% of recycling. In all cases a variety of policy measures was adopted including 'pay as you throw' schemes and differentiated taxation, door-to-door collection schemes, higher possibilities in engaging/awareness and education of inhabitants (also by means of IT innovations), and solutions responding to the characteristics of the territory. An outstanding example is provided by the municipality of Capannori (Italy), which in 2013 managed to achieve figures of 82% of separately collected waste, achieving a reduction of 39% of waste produced when compared to 2004. A further example is the municipality of Palarikovo (Slovakia)[15] which managed to reduce waste to landfill by 63% from 1999 (starting from 100%) and increase recycling accordingly. Thus, differences in recycling rates can be substantial at a regional level, giving a clear indication of how regional and local policies can play primary roles in the achievement of targets at local level.

Evidences presented above can be complemented with the information presented in Annex II, showing differences in recycling level within different regions and main difficulties in implementation for a number of Member States (based on data provided by EEA singular report on Municipal Waste Management, EEA 2013)

It is possible to evidence two groups of Member States: a first on presenting substantial differences in recycling level within different regions and with national low landfilling rates, and a second group characterized by no substantial

15 F. Montevecchi, 2013: "Reducing municipal waste at the local level in Slovakia" FP7 Project DYNAMIX - policy mix evaluation. Available at: http://dynamix-project.eu/sites/default/files/Waste_Slovakia.pdf.

difference in the level of recycling within the regions and high national landfilling rates. In general, it can be argued that latter regions cannot yet show impacts from the implementation of the waste targets, as the whole country is still struggling with implementation of measures and policies at national level.

Thus, EU targets and national targets are the overall drivers of better municipal waste and necessary to move the country away from landfilling practices, but regional policies and local implementation have a key role in the effectiveness of the waste management system.

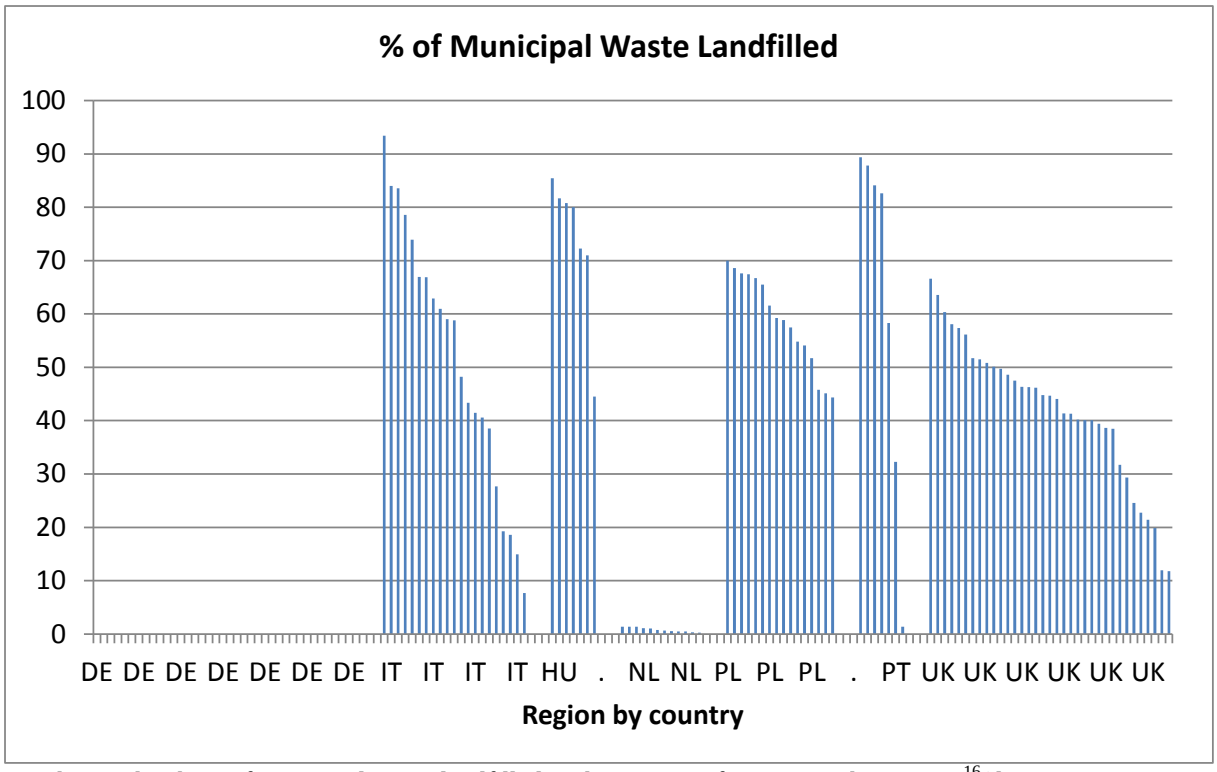
Eurostat data analysis

Further analysis was conducted by the authors of this report with respect to municipal waste collection coverage, recycling, and landfilling at regional level based on more recent Eurostat data.

Regional data can be examined against the average national municipal waste coverage. e.g. the difference between the region with the highest coverage and the region with the lowest coverage in Hungary is 13%. In Poland this difference is 30%. However, in both countries in 2011 none of the regions yet achieved full coverage.

This indicates that within these countries the regions develop their municipal waste management systems mostly in parallel, but there are always some more advanced regions, and other regions which fall behind.

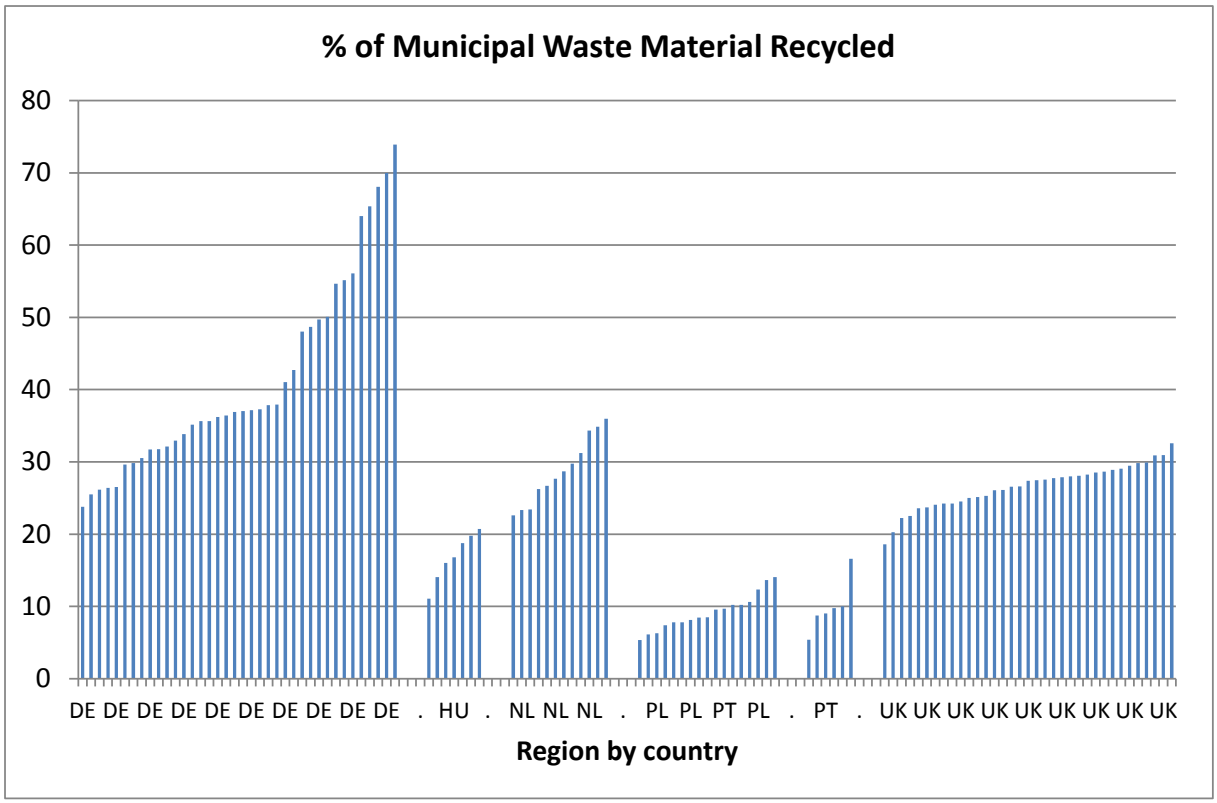
With regard to landfilling, Graph 13 shows the share of municipal waste that is landfilled by the regions of 7 EU Member States. In 2 countries (Germany and the Netherlands) there is virtually no landfilling of untreated municipal waste. Italy, Hungary, Poland, Portugal and the United Kingdom depend heavily on landfill for managing their municipal waste. The regional differences, however, are big. In Italy the region with the highest landfilling share is Sicily with 93%. In contrast Lombardy landfilled only 8% of its municipal waste. In Poland the regional differences are much smaller ranging from 70% in Opolskie to 44% in Mazowieckie.



Graph 13: The share of municipal waste landfilled in the regions of 7 EU Member States [16](data source: Eurostat 2014)

Graph 14 shows the share of municipal waste which is used for material recycling for 6 EU countries (data from Italy is missing). In Hungary, the Netherlands, Poland, Portugal and the UK the difference between the region with the highest material recycling share and the region with the lowest share is somewhere between 10 and 15%. This indicates that with respect to the development of recycling systems the regions in these countries go strongly in parallel. An exception is Germany, where 14 out of 38 regions have managed to achieve exceptionally high material recycling rates (of more than 40 %), as compared to other countries, but also as compared to the other German regions (with material recycling rates of 24 to 38 %).

[16] The data for Italy is from 2010, all other countries is from 2011.



Graph 14: The share of municipal waste recycled to recycling material (without composting) in the regions of 6 EU Member States in 2011 (data source: Eurostat 2014).

It can be concluded that the barriers limiting the establishment of a compliant waste management system are a mix of both regional and country specific issues.

2.1.3. Feedback of the Member States on the targets of the Waste Framework Directive 2008/98/EC, the Landfill Directive 99/31/EC and the Packaging Waste Directive 94/62/EC

A report with feedback from Member States on the state of the implementation of EU targets set by the EU Directives into national legislation had been released by the European Commission in 2009 [17],[18].

Overall, Member States' reports for the period 2007 to 2009 highlight that EU legislation on waste is to a large extent properly transposed into national legislation, but Member States still struggle with important problems regarding practical implementation and enforcement, especially concerning the 2006 WFD, and the Landfill Directive.

[17] European Commission, 2013: REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS on the implementation of the EU waste legislation". Brussels, 17.1.2013 COM(2013) 6 final.
[18] Note: singular reports were not available for consultation.

Concerns remain about the proper implementation of the waste management hierarchy, even in its three-step version, with a high degree of dependence on landfilling, although some progress could be observed during this reporting period. The most important barriers to better implementation at Member State level include the lack of commitment and resources for implementation control and enforcement, in combination with structural, institutional and constitutional constraints. Major improvements could lead to benefits. A recent study published by the Commission shows that full implementation of EU waste legislation would save €72 billion a year, increase the annual turnover of the EU waste management and recycling sector by €42 billion and create over 400,000 jobs by 2020.

Waste Framework Directive 2008/98/EC

Overall, Member States have confirmed having transposed the Directive into their national laws and complying with its basic requirements, establishing one or more WMPs, and undertaking steps towards self-sufficiency in waste disposal.
In addition, Member States have confirmed compliance with the provisions of the 2006 WFD on permit requirements and record keeping.

An important deficiency in the application of the Waste Framework Directive can be identified in terms of the waste treatment options chosen, as many Member States still largely depending on landfilling of household waste, hampering proper waste recycling and resource recovery and leaving more than half of the existing resources embedded in waste unused. Thus, immediate efforts need to be taken to step up introducing modern, resource-efficient waste management systems.

Overall figures on waste management in general, and on municipal waste management in particular, remain unsatisfying.

Packaging Waste Directive 94/62/EC[19]:

In general, Member States have properly transposed the requirements of the Directive into their national laws, and it is assumed that the overall quality of implementation continues to be satisfactory.

[19] Directive 2005/20/EC and the Treaties of Accession grant a later deadline to meet the targets for the countries which have acceded the European Union in 2004 (the Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Slovenia, Slovakia) and 2007 (Romania and Bulgaria).

The vast majority of Member States have managed to comply with EU targets for overall recovery and recycling as well as the material-specific recycling targets, with some exceptions. The majority of Member States have taken measures to prevent the formation of packaging waste. However, the prevention of packaging waste and the development of packaging re-use systems remains a continuous task for Member States, with some Member States consistently failing to achieve the overall recovery/recycling targets, or material-specific targets, over the reporting period.

Overall, the level of implementation of the Packaging Directives is by and large satisfactory, with only a few Member States missing single targets.

Directive 1999/31/EC on the Landfill of Waste

Member States have transposed most requirements of the Directive into their national laws. All Member States have taken measures to: reduce the landfilling of municipal waste (including prevention programmes), adopt national strategies and measures to reduce the amount of biodegradable waste going to landfills, transpose technical requirements of the Directive (monitoring of leachate7, surface, groundwater and gas emissions) into national legislation (including the definition of waste acceptance criteria for different landfill classes), and indicate that all landfills in operation comply with the requirements of the Directive.
Many Member States have taken successfully measures to completely eliminate landfilling, with landfilling rates for municipal waste below 5% (e.g. Belgium, Denmark, Germany, the Netherlands, Austria and Sweden). However, in many countries landfilling is the predominant (if not the only available) municipal waste management option. In addition, at the end of the reporting period 2007 - 2009, there were still a considerable number of non-compliant landfills in operation, although their number has decreased in comparison with the previous report (especially in the case of landfills for non-hazardous waste).

Thus, significant efforts need to be made by Member States to move away from waste landfilling.

Responses on the revision of the targets from the Waste Framework Directive, the Packaging Directive and the Landfill Directive and on targets to be derived from the Road Map on a Resource Efficient Europe

In 2013 a stakeholder survey on the revision of the targets from the Waste Framework Directive, the Packaging Directive and the Landfill Directive and on targets to be derived from the Road Map on a Resource Efficient Europe (European Commission 2011) took place. Out of 670 responses 47 were from

national, regional or local public administration institutions from 17 EU Member States.

The main results of the survey (with the highest relevance to this file note) are given below. Where possible, the response of the public administration group (Hogg et al. 2013), it is also given.

With respect to the targets for the Road Map on a Resource Efficient Europe (European Commission 2011) 84% of the public administration groups supported that the European Commission should set waste prevention targets. 86% of these groups also supported the European Commission in principle expanding/increasing recycling targets. The support of this group is strongest for food waste prevention targets, followed by WEEE and packaging waste prevention targets. This group also gives strong support to the requirements:

- → that waste generated per capita is in decline by 2020.
- → that consistent reporting of levels of household waste should be achieved across Member States (Hogg et al. 2013).

In contrast there quite diverging views on defining different waste targets for different EU Member States, taking into account the different situations of the different countries. 58% of the public administration groups in the survey supported an adaptation of recycling targets to the different conditions in the EU Member States, while 42 % of this group opposed this idea.

According to the public administration groups which were surveyed, new recycling targets may be considered primarily for biowaste, plastics and textiles (Hogg et al. 2013).

With respect to the municipal/household waste recycling targets in the Waste Framework Directive responses most relevant for this File Note are:

- →The obligation to have separate collections is not clearly defined.
- →Targets focus too much on the quantity of collected waste and not enough on the actual rates of reuse and/or recycling.
- →The Waste Framework Directive does not distinguish well between different forms of recycling (e.g. closed- vs. open-loop recycling).
- →The quality of the recyclate/final product is not taken into account in the existing targets.
- →Weight based targets are inadequate as they do not take into account the differences in the environmental impacts of different materials.
- →Separate targets for biowaste or other waste streams such as textiles are missing.

Responses to the targets on municipal waste included:

- →Set either municipal waste targets or household waste targets and use the same definitions in all Member States to make the recycling rates comparable.
- →Set targets which reflect environmental weightings for materials (for example, through reference to greenhouse gas savings achieved through recycling).

For EU Member States' public administrations it is of special importance that monitoring and validation of the reports submitted by Member States is improved so that the consistency and reliability of data can be validated (Hogg et al. 2013).

With respect to construction and demolition waste for EU Member States' public administrations it is of special importance that clear definitions of recycling and material recovery are provided, and how these should be calculated for the C&D waste stream (Hogg et al. 2013).

The following proposals regarding the Packaging Directive found the highest support in the public administration responses:

- →Adjust the definitions for reuse and recycling in the Packaging Directive to be consistent with those contained in the Waste Framework Directive.
- →The methodology for calculating recycling rates should be standardised so that data (and hence performance levels) are comparable across Member States.
- →Remove from the Directive the maximum limit of 80% that stipulates how much packaging waste a Member State is allowed to recycle.
- →Expand the recycling target to include reuse, by allowing the reuse of packaging to be credited to the recycling target.
- →Introduce a target for prevention of packaging waste.
- →Set specific targets for recycling of packaging waste from households to encourage further recycling of household packaging.
- →Introduce targets for reuse for commercial transit packaging.
- →Incorporate "weightings" for materials recycled based on environmental benefits derived from recycling the material.
- →Introduce targets for reuse for all packaging (Hogg et al. 2013).

The stakeholder survey provides data on new packaging waste recycling targets recommended by public administrations from 17 EU Member States (Hogg et al. 2013). These new targets are shown in Graph 15 in comparison with the existing targets and recycling levels, which were achieved within the EU27 on average in 2011. While some of the new targets proposed by the public administrations are at, or even below, the existing achievements, the respondents expect that for

plastics, wooden packaging and glass much higher recycling rates will be achievable by the year 2023 than reached so for. In total the respondents from public administrations believe that a packaging waste target of 75% should be set for the year 2023 (Hogg et al. 2013).

Graph 15: Packaging waste recycling rates – existing targets, achievements by EU27 and new targets as proposed by public administrations from 17 EU Member States during a survey (Eurostat 2014, Hogg et al. 2013)

With respect to a revision of the Landfill Directive targets, the following two proposals are seen equally favourable by the public administration group of the survey:

→Either Landfilling of recyclable/compostable waste (to be defined) should be banned; or

→Landfilling of waste should be banned if it has not been pre-treated to a level where the potential to lead to methane emissions from landfills has been virtually eliminated (Hogg et al. 2013).

2.2 The impact of current waste legislation

2.2.1. What is the effect/impact on territories of the 3 Waste Directives?

The following analysis is taken from Monier et al. (2011) showing the costs, effects and impacts of the European waste management legislation on the EU economy. It compares two different scenarios – the impacts of European waste legislation till 2008 (scenario A) with the impacts of the European waste legislation scheduled to be achieved by the year 2020 (Scenario B). This analysis is based mainly on experience gained in the German region of Brandenburg (Monier et al. 2011).

The two scenarios are defined as follows:

→Scenario A: No further development of waste management systems as compared to the year 2008.

→Scenario B: Full implementation of waste legislation.

The difference between Scenario B and Scenario A shows the incremental benefits from the 2008 state of implementation to full implementation of existing EU waste legislation.

Table 4 shows the main results of the scenario analysis to be:

- A reduction in the amount of waste generated in Scenario B (full implementation of waste legislation) as compared to Scenario A (No further development of waste management system as compared to 2008) due to waste prevention.
- An increase in material and energy recovery.
- Prevented greenhouse gas emissions, due to reduced emissions from landfilled waste and due to prevention of emissions in other sectors by material recycling and energy recovery.

Table 4: Difference between waste, material and energy flows as well as greenhouse gas emissions of scenario B and scenario A in the year 2020

	Unit	Scenario A	Scenario B	Difference (B-A)	Difference (B-A) in % of A
Waste generation					
Total	Mt	2,984	2,864	-119	-4
Treatment					
Total landfilling/incineration without energy recovery, other disposal	Mt	1,927	996	-931	-48
of which MSW	Mt	230	69	-161	-70
Material recovery	Mt	951	1,637	686	72
Energy recovery	Mt	106	231	125	118
Energy recovery	PJ	1,544	3,288	1,744	113
GHG emissions					
GHG emission avoided by material and energy recovery	$Mt_{CO2,e}$	209	324	115	55
GHG emission from MSW landfilling	$Mt_{CO2,e}$	142	42	-99	-70
Total difference in GHG emission	$Mt_{CO2,e}$			215	

Table 5 shows the amount of secondary materials recovered from waste in Scenarios A and B. In Scenario B, a total of 1,637 million tonnes of secondary raw material is recovered in 2020. This is 686 million tonnes more than in Scenario A (than without a full implementation of EU waste legislation).

Table 5: Recovery of secondary raw materials in the year 2020 in Mt

	Unit	Scenario A	Scenario B	Difference (B-A)	Difference (B-A) in % of A
Glass	Mt	9.6	17.7	8.1	83.7
Paper and cardboard	Mt	33.0	59.4	26.4	79.8
Plastics	Mt	3.8	9.2	5.4	141.1
Iron and steel	Mt	76.9	101.7	24.8	32.2
Aluminium	Mt	3.0	4.3	1.3	43.5
Copper	Mt	0.8	1.3	0.4	51.6
Zinc	Mt	0.6	1.3	0.6	99.8
Lead	Mt	0.5	1.0	0.5	85.2
Other metals	Mt	0.5	1.0	0.6	122.2
Waste Wood	Mt	20.4	29.9	9.5	46.6
Textiles	Mt	2.5	4.7	2.1	84.9
Rubber and tyres	Mt	1.5	1.7	0.2	14.2
Bio-waste	Mt	28.2	108.5	80.3	284.4
Oil containing waste	Mt	2.0	2.8	0.8	40.3
Spent solvents	Mt	0.4	0.6	0.2	67.4
Ashes and slag	Mt	74.6	69.8	-4.8	-6.5
Mineral construction material	Mt	692.1	1,222.2	530.1	76.6
Total	**Mt**	**951**	**1,637**	**686**	**72.2**

For the year 2020 it was estimated that the full implementation of existing EU waste legislation would cost 187 billion €, while the benefits gained from the

EU waste management and recycling system represent a value of 202 billion € in this year.

The benefits of a full implementation of EU waste legislation in EU-27 by the year 2020 can be described as follows:

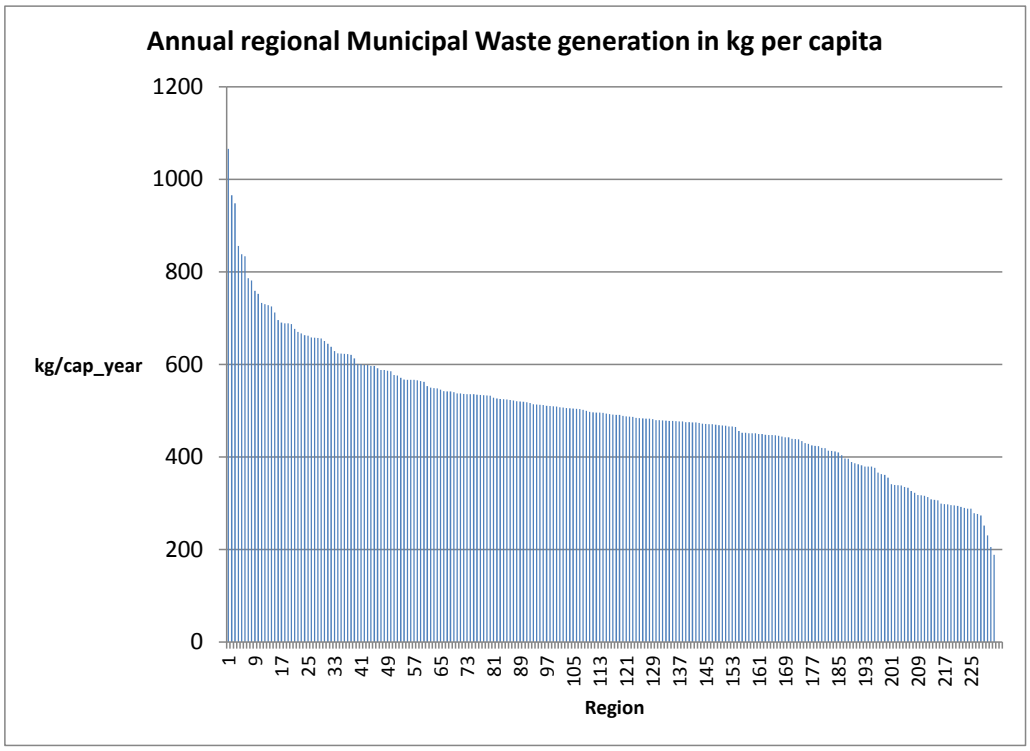
- By applying waste prevention measures the generation of waste can substantially be reduced.
- By introducing and improving separate collection systems, by improving waste treatment, by actively discouraging landfilling and by developing recycling markets the amount of waste recycled and secondary material produced can be increased. This leads to a reduction of primary material consumption and related environmental impacts. Biodegradable waste is composted and, if unpolluted, used as a fertiliser.
- By improved separate collection systems and waste treatment also the share of waste that is used as secondary fuel is increased without polluting the environment. Waste is incinerated in specialised incineration plants with sophisticated pollution control and off-heat utilisation. Biogas from biological treatment plants and landfill-gas is collected and used as fuel for power and heat generation.
- Waste prevention, increased recycling and improved treatment together reduce the amount of waste to be landfilled. Compliant landfill-systems tend to use landfills with a smaller specific area consumption per tonne of waste landfilled. It is therefore estimated that the total area consumption for the waste landfilled in the year 2020 in EU-27 in a fully compliant system is 64% smaller than in a system without increasing compliance above the year 2008 level. This in turn results in a lower pressure on biodiversity.
- Keeping biodegradable and other reactive waste from landfills and equipping landfills with base, side and cover lining and leachate control additionally reduces the emissions of pollutants such as heavy metals or soluble/volatile organic compounds from landfills into air, water and on soil and reduces the emissions of dust and stench.
- In a fully compliant system no waste and especially no hazardous waste such as waste from electric and electronic equipment (WEEE) or batteries from end-of-life-vehicles (ELV), is illegally exported. If waste is exported, it is treated to the same environmental standards as if it would be treated within the EU.
- The impact of waste on human health for all EU-citizens is reduced to almost zero, leading to increased life expectancies.
- The impact on animals and plants, on biodiversity and nature-protected-areas is much reduced.
- Greenhouse-gas emissions are reduced within the waste management sector and by replacing primary energy and materials in other sectors by an estimated total of 215 Mt CO2.

- Emissions of ecotoxic, acidifying, eutrophying and ozone depleting substances are substantially reduced (Monier et al. 2011).

2.2.2. Does it affect certain regions more than others?

Eurostat provides waste management data on 234 EU-regions, ranging in size from 316 km² (Bruxelles) to 94.226 km² (Castilla y León) and ranging in population from 128,000 inhabitants (Valle d'Aosta) to 11.8 Million inhabitants (Ile de France).

In these regions municipal waste generation ranges from 189 to 1066 kg/capita.year for the latest reported year (which is mostly 2011 but also may be 2008, 2009 or 2010). The average lies at 500 kg/capita.year. For the spread of per capita municipal waste generation over the regions see Graph 16, which shows that about 20 % of the regions had not achieved full coverage of municipal waste collection in the latest year of reporting.

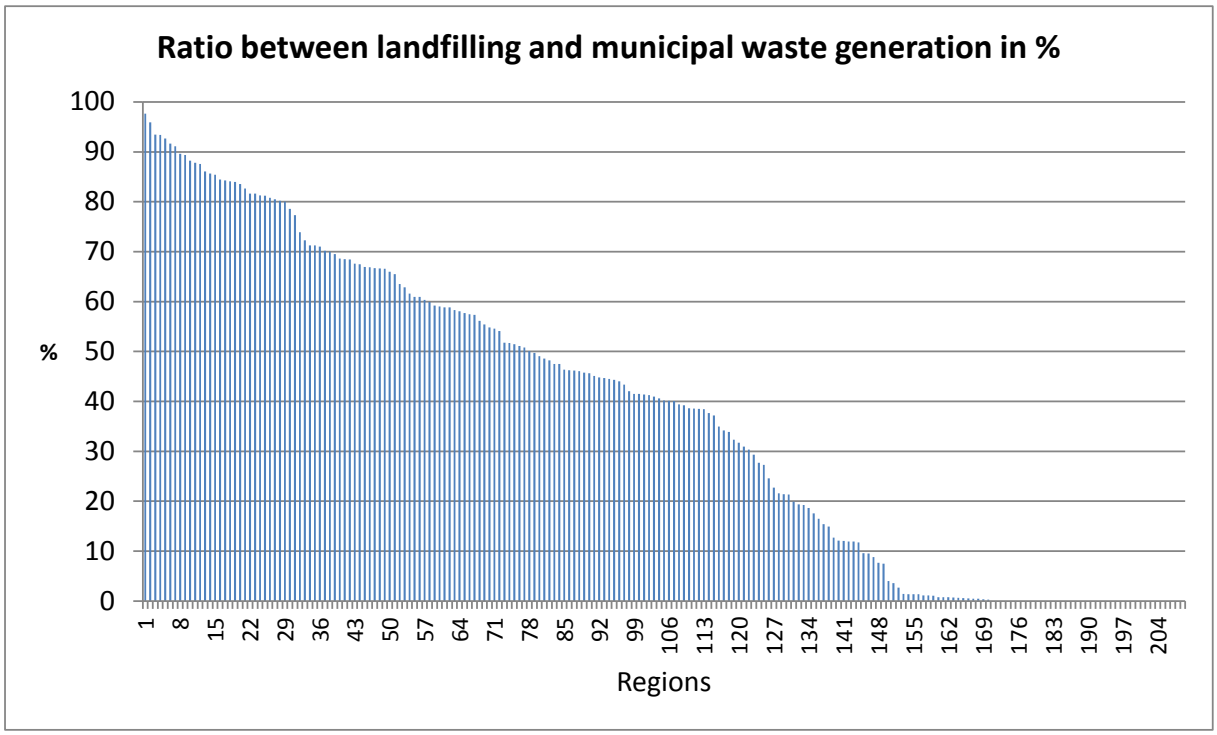


Graph 16: Spread of annual per capita municipal waste generation over 232 the regions for which municipal waste data are reported by Eurostat (2014).

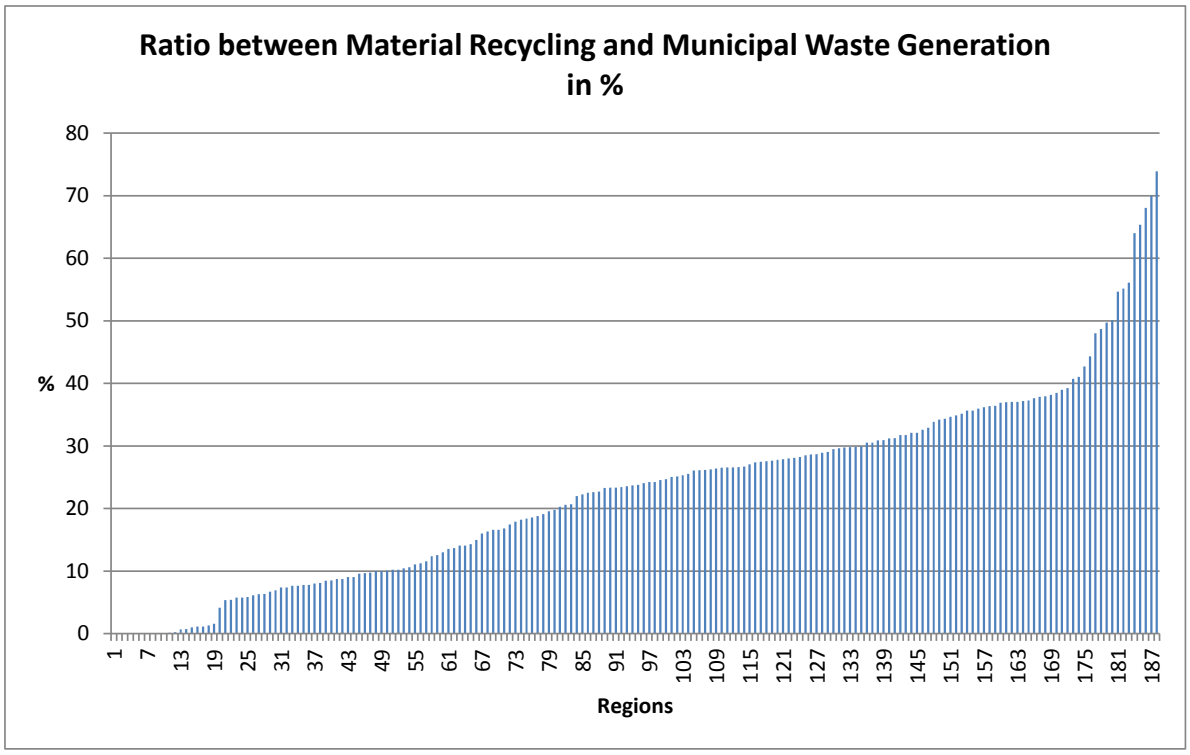
Out of 106 regions with complete data sets, 31 regions were reported to have landfilled or treated less than 90 % of the municipal waste generated in the latest year of reporting. This is a strong indication that, as of 2011, between 10 and 30 % of the EU regions had not established a full municipal waste management system.

Graph 17 shows the share of landfilling on total municipal waste treatment in 209 EU regions. While 57 of the regions (27%) do not landfill untreated municipal waste, 29 regions (14 % of the reporting regions) depend on landfilling more than 80% of their waste. In total 38% of the reporting regions landfilled more than 5 % of their municipal waste.

Graph 18 shows the municipal waste material recycling rates for 188 reporting regions. While one region (Trier) achieves a recycling rate of 74%, 12 regions do not apply material recycling at all. The average material recycling rate lies at 23%.
Graph 19 shows the municipal waste total recycling rates for 188 reporting regions, taking into account material recycling and composting. While 15 regions achieve total recycling rates of, or above, 70%, 16 other regions achieve total recycling rates of less than 2%. The average total recycling rate of the 188 regions was 39%.

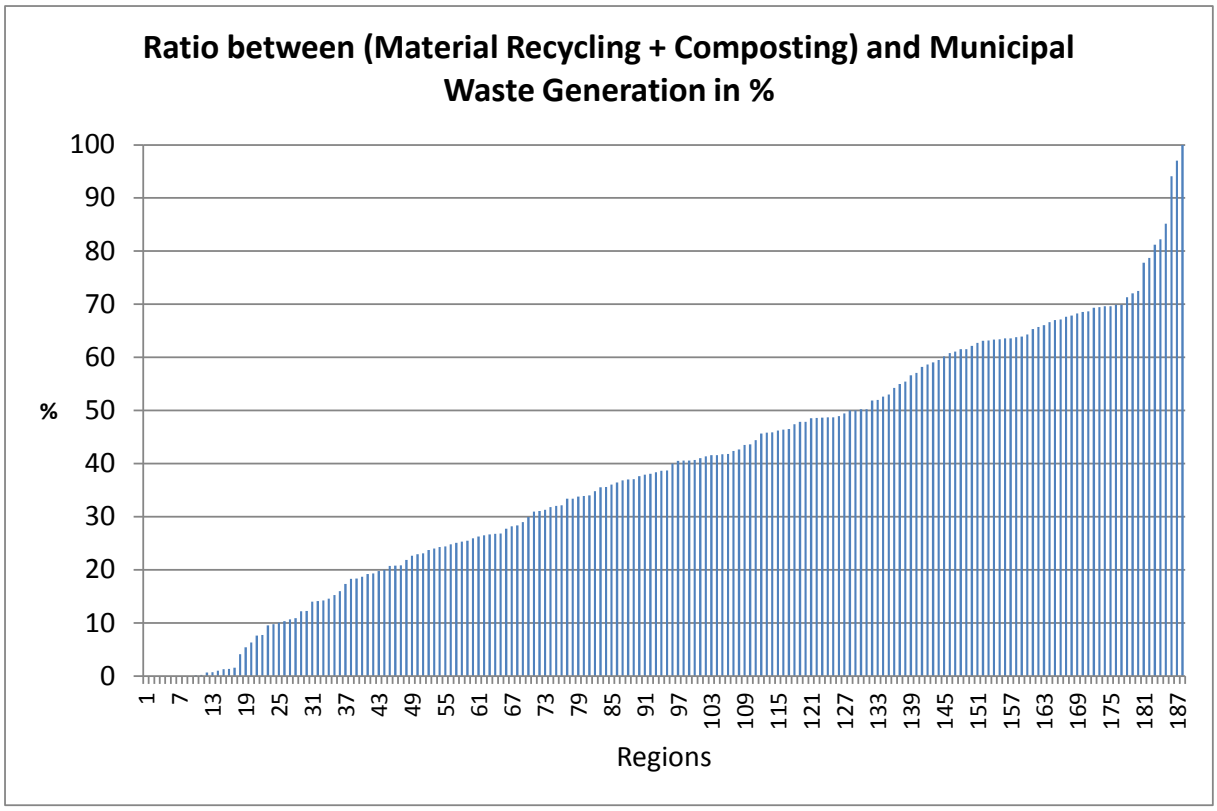


Graph 17: Landfilling Share – ratio between landfilling and municipal waste generation for 209 regions (data: Eurostat 2014)



Graph 18: Material Recycling Rate – ratio material recycling and municipal waste generation for 188 reporting regions (data: Eurostat 2014)

The data above has to be used with some care. A 100% recycling rate due to impurities and treatment losses is thermodynamically not possible. The data likely shows the share of the generated municipal waste which is supplied to recycling and composting installations. It is very likely that the actual recycling rate, that is the share of the municipal waste generated, which is effectively reused after treatment, is much lower than the 100%, which was, for example, reported by one region.



Graph 19: Total Recycling Rate – ratio between (material recycling + composting) and municipal waste generation for 188 reporting regions (data: Eurostat 2014)

2.2.3. Are certain types of territories affected?

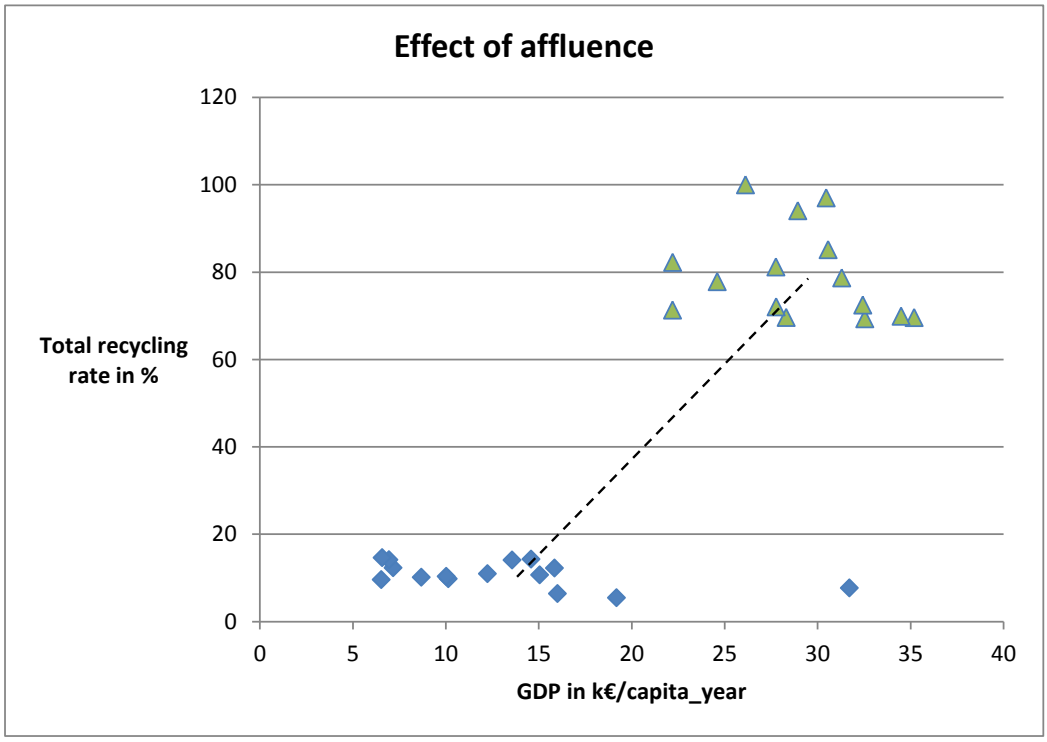
One of the ultimate objectives of the EU is that all European regions achieve a high total recycling rate.

From the regions which provided a full dataset for the year 2011, the 15 regions with the lowest total recycling rates and the 15 regions with the highest total recycling rates are selected to investigate which factors influence the total recycling rate.

The (15 selected) regions with the lowest recycling rates are in Lithuania, Poland, Slovakia, Hungary, Malta and Portugal, that are mainly on the eastern and southern rim of the European Union. Most of these regions joined the European Union as late as 2004 and might not yet have had enough time to achieve the same levels of development as regions which have been part of the European Union for a longer time. However, there are also many regions which are long time members of the EU which have a total recycling rate below 30 %. From the 15 regions with the highest recycling rates, 1 is in Belgium, and 14 are in Germany. Within Germany both old and new regions achieve high recycling rates. Thus it can be seen that in principle it is possible to achieve a high waste management standard, approximately 25 years since the re-unification of the German regions.

Graph 20 shows the correlation between affluence and recycling rates in the 30 selected regions. It can be seen that in all but 1 region with a low recycling rate, these have an annual per capita GDP of less than 20,000 €. Conversely, all regions with high recycling rates had an annual per capita GDP of more than 20,000 €.

It can be concluded, that certain minimum affluence might be necessary to achieve a high recycling rate. When assuming that an annual per capita GDP of 20,000 € is necessary to achieve a total recycling rate of 70%, it would be necessary to substantially boost the economic output of 89 of the 271 EU NUTS2-regions, or of 33 % of all EU regions to achieve this total recycling rate.



Graph 20: Effect of regional affluence on the total municipal waste recycling rate for the year 2011 in 30 selected regions (data: Eurostat (2014))

The example of the data point in the lower right part of Graph 20, however, shows that affluence alone is not enough to achieve a high recycling rate. So other factors must be crucial, too, for achieving a high recycling rate.

A recent study of 6 regions in (Lombardy and Campania in Italy, Mazurian and Lodz in Poland as well as Catalonia and Castile in Spain) (ETC/SCP 2014a) reveals the following success factors for achieving a comprehensive municipal waste management system and relatively high recycling rates:

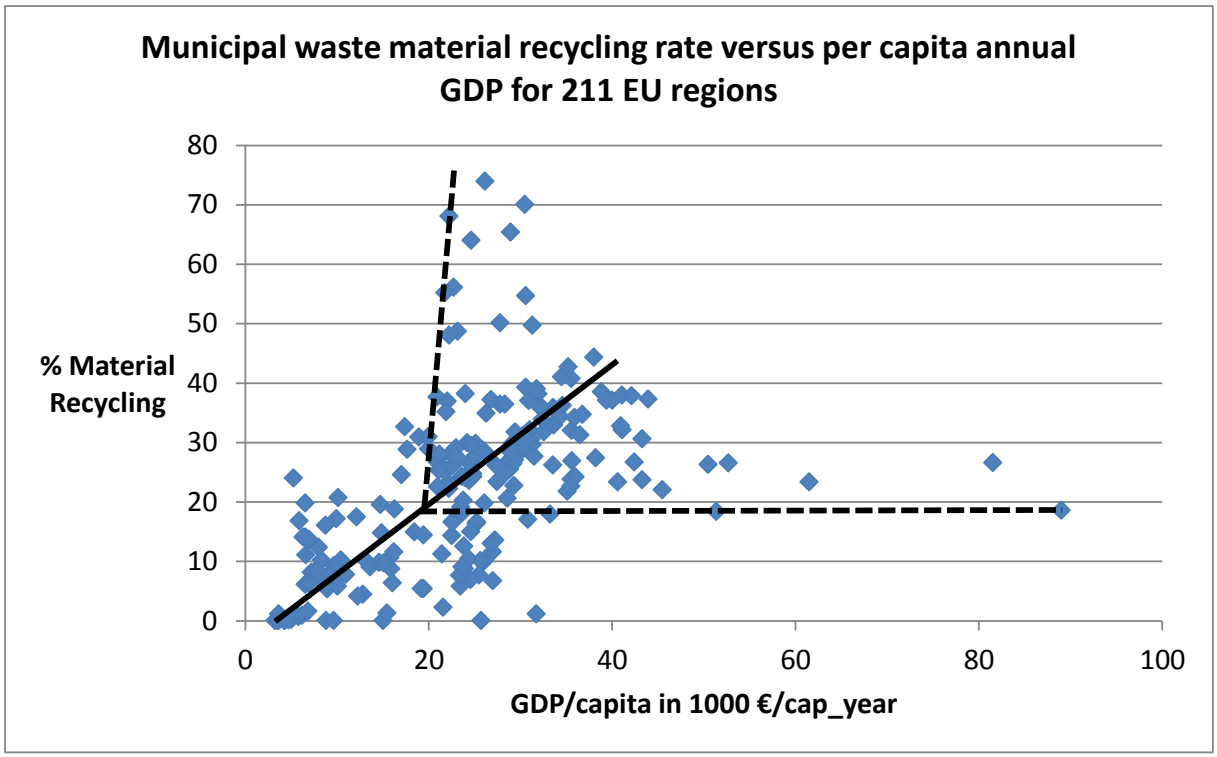
- Precise and binding minimum targets e.g. for the percentage of separately collected waste.
- Control of the quality of the separately collected waste.
- Door-to-door separate collections.

- Efficient and effective producer responsibility systems for packaging waste, WEEE and batteries as a source of financial sustainability for separate collections.
- Cooperation between municipalities to implement a complete waste prevention, collection, treatment and recycling system by means of sub-regional waste management associations.
- Potential investors in the waste collection, sorting and treatment infrastructure need a certain security of supply. For assuring this security of supply it is crucial that public authorities have control concerning which waste facilities the collected waste is delivered to (ETC/SCP 2014a)
- Use of a landfill tax.

The following barriers to achieving high recycling rates were identified by ETC/SCP 2014a:

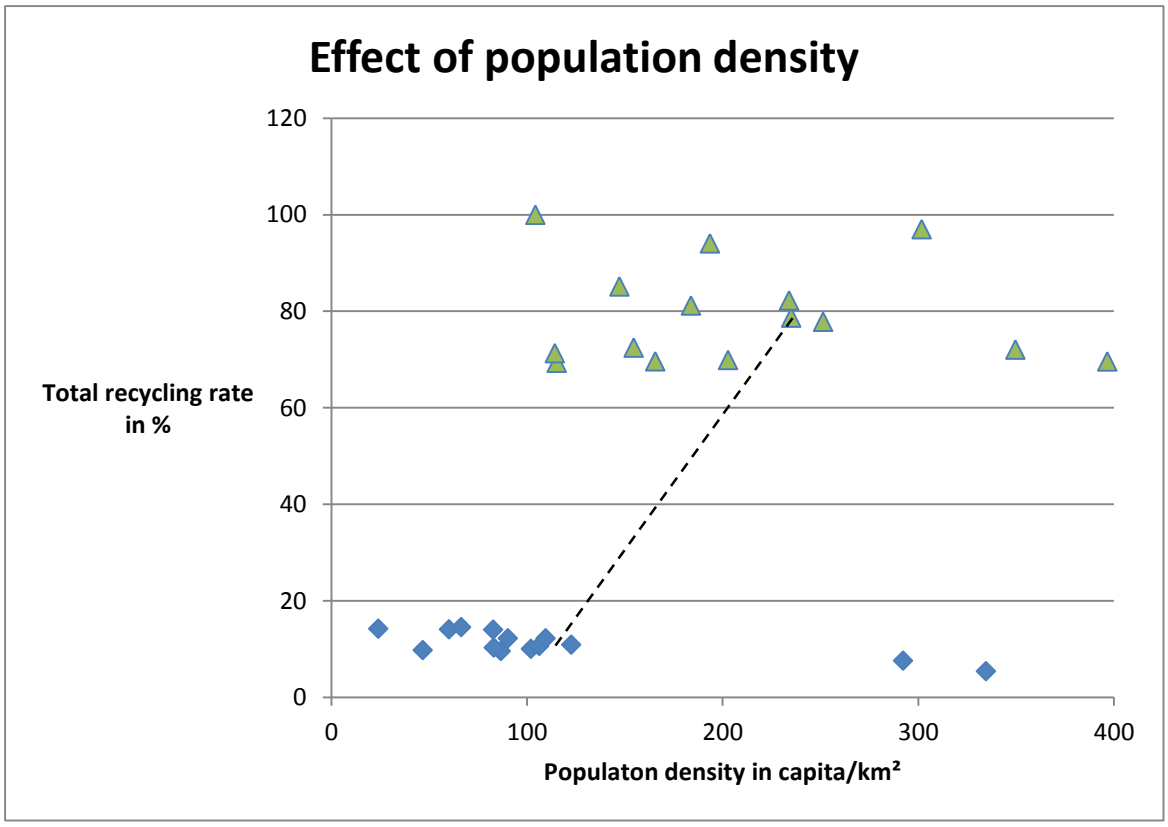
- Low quality of separately collected waste.
- A single municipality is often too small to implement a complete waste prevention, collection, treatment and recycling system.
- Lack of investment security.
- Availability of cheap alternative treatment facilities such as MBT (mechanical biological treatment).

A similar result as shown in Graph 20 is achieved when drawing the municipal waste material recycling rates of all 211 regions which have reported in recent years against the annual per capita GDP of these regions (see Graph 21). There is a general trend that higher affluence (higher per capita GDP) leads to higher recycling rates. So a minimum per capita GDP of 20,000 €/year seems to be necessary to achieve material recycling rates above 40%. However, a per capita GDP above 20,000 €/year does not guarantee a high recycling rate. Above the 20,000 €/year threshold other factors than the region's affluence become limiting and need to be addressed.



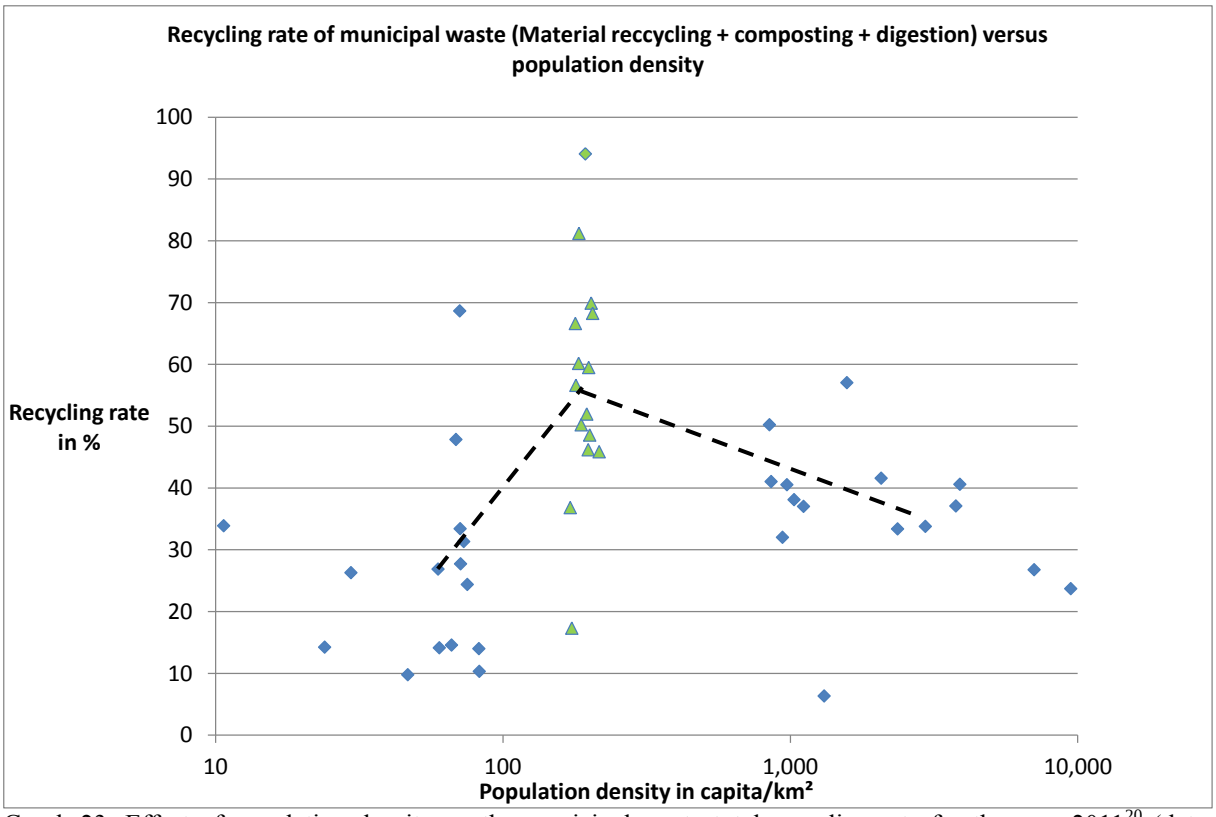
Graph 21: Effect of regional affluence on the municipal waste material recycling rate in 211 regions (data: Eurostat (2014))

Graph 22 shows the effect of population density on the total municipal waste recycling rate – with 14 regions having low and 15 regions having high recycling rates. A low population density may be a limiting factor for achieving high recycling rates. The specific costs for collecting and transporting municipal waste are higher in low population density regions. Therefore, it is likely to require more costs to achieve high recycling rates in low population density areas. As can be seen in Graph 22, however, a high population density is no guarantee for a high recycling rate.



Graph 22: Effect of population density on the municipal waste total recycling rate for the year 2011: 14 regions with lowest recycling rate and 15 regions with highest recycling rate (data: Eurostat (2014))

When selecting 15 regions with lowest population density, 15 regions with population densities around the median of 132 regions, and 15 regions with highest population densities for investigating the effect of population density on the municipal waste recycling rate it can be seen, that both low population density regions and very high populating density regions have difficulties in achieving high recycling rates. It can be concluded that also a high population density (such as in large towns) is a limiting factor for achieving high recycling rates. In regions of very high population density there is not enough space for installing all the bins for the separate collection of the different municipal waste types and for home-composting, both leading to a high generation of residual waste, which is difficult to recycle.



Graph 23: Effect of population density on the municipal waste total recycling rate for the year 2011[20] (data: Eurostat (2014))

Even cities which have a more than 20 years tradition in separate waste collection and recycling such as Vienna in Austria, and Berlin, Cologne or Hamburg in Germany, seem to have difficulties in achieving recycling rates of more than 50 % (see Table 6**Error! Reference source not found.**).

Table 6: Large German and Austrian towns with lowest recycling rates (data from Eurostat 2014).

	Recycling rate (including composting/digestions) in %	**Population density in capita/km²**	**Reference year**
Hamburg	33.4	2365.5	2011
Düsseldorf	40.5	975.6	2011
Berlin	40.6	3898.5	2011
Köln	48.7	596.5	2011
Wien	48.5	4134.4	2009

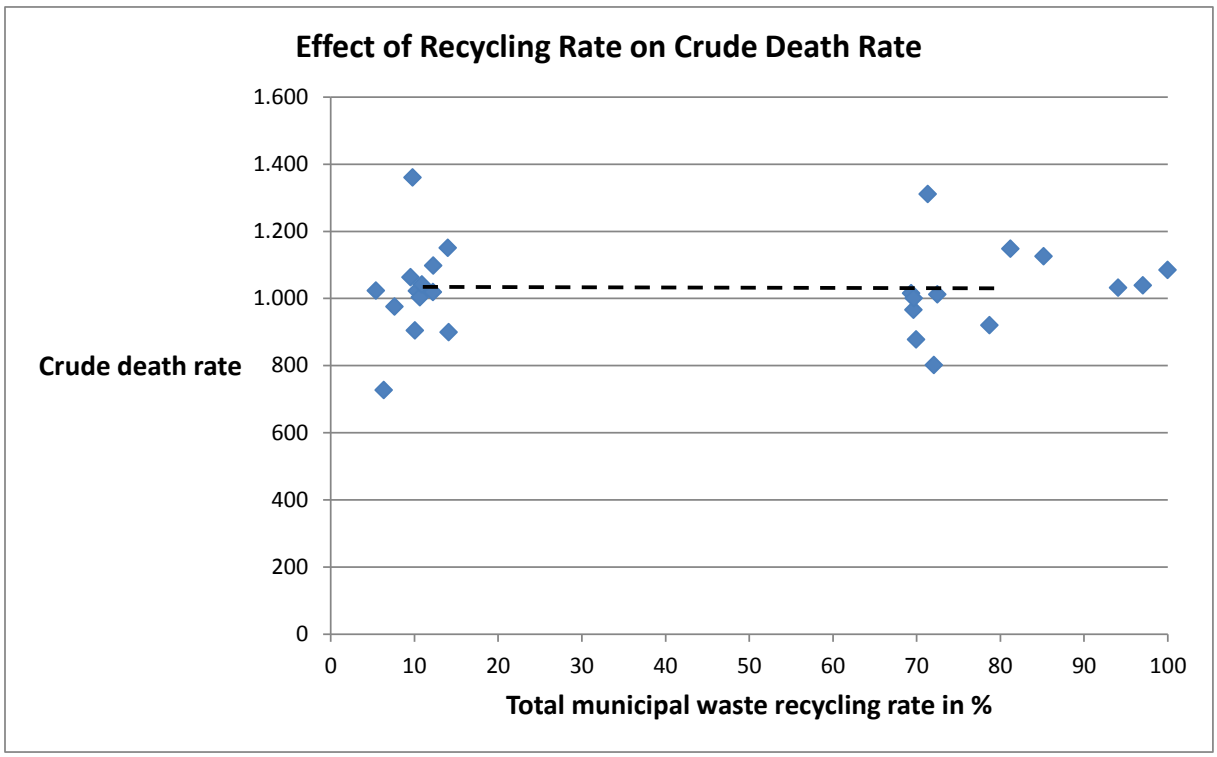
[20] (15 regions with lowest population density + 15 regions with population densities around the median of 132 regions + 15 regions with highest population densities)

In order to get a better understanding as to which additional factors the regional recycling rate may depend 3 additional socio-economic factors (provided by Eurostat) were investigated. These include:

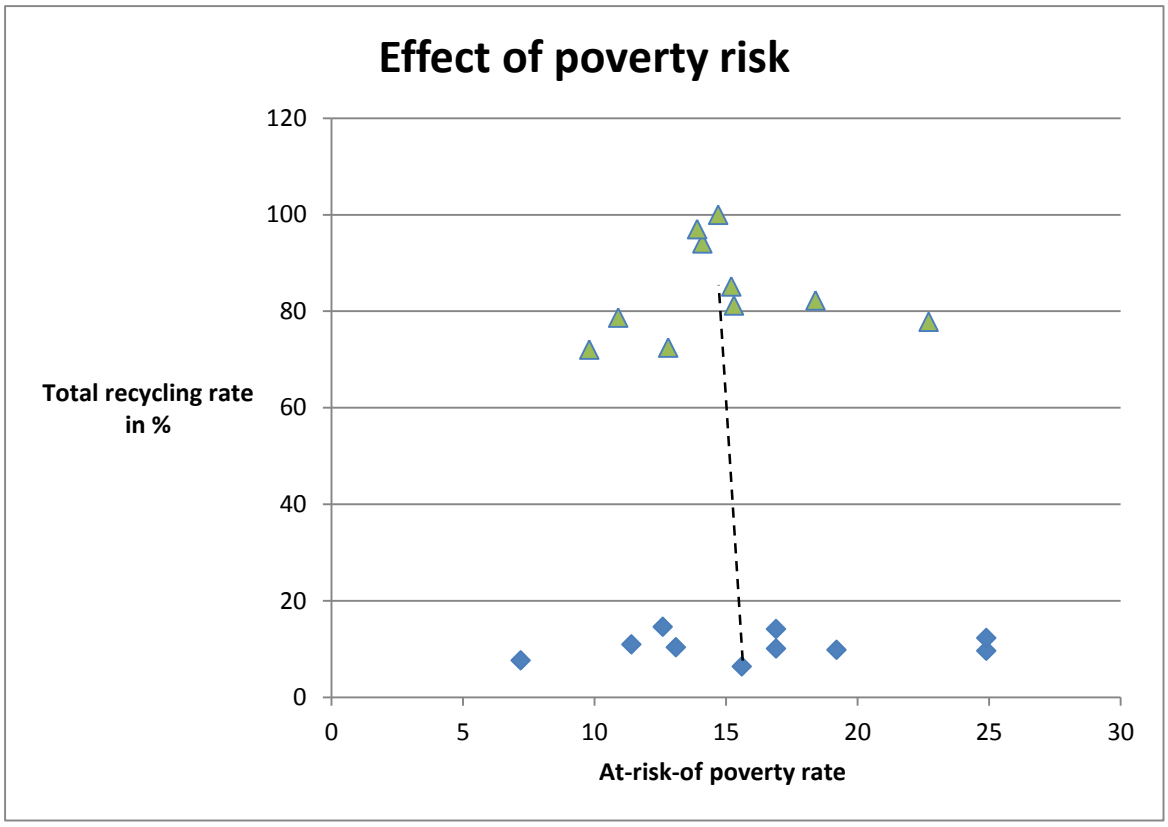
- The crude-death-rate;
- The at-risk-of-poverty rate; and
- The percentage of households with access to the internet at home as a general regional development indicator.

The results for the regions with the lowest and the highest municipal waste total recycling rate are shown Graph 24, Graph 25 and Graph 26.

Graph 24 shows, that there is no significant effect of the recycling rate on the death rate. Graph 25 shows that the at-risk-of-poverty-rate slightly drops with increasing recycling rate. Both the sample and the effect, however, are too small to judge if the drop is significant. In any case it would not be possible to judge if regions with a lower at-risk-of-poverty-rate can afford to invest in higher recycling rates or if the higher recycling rate contributes to reducing the at-risk-of-poverty-rate.



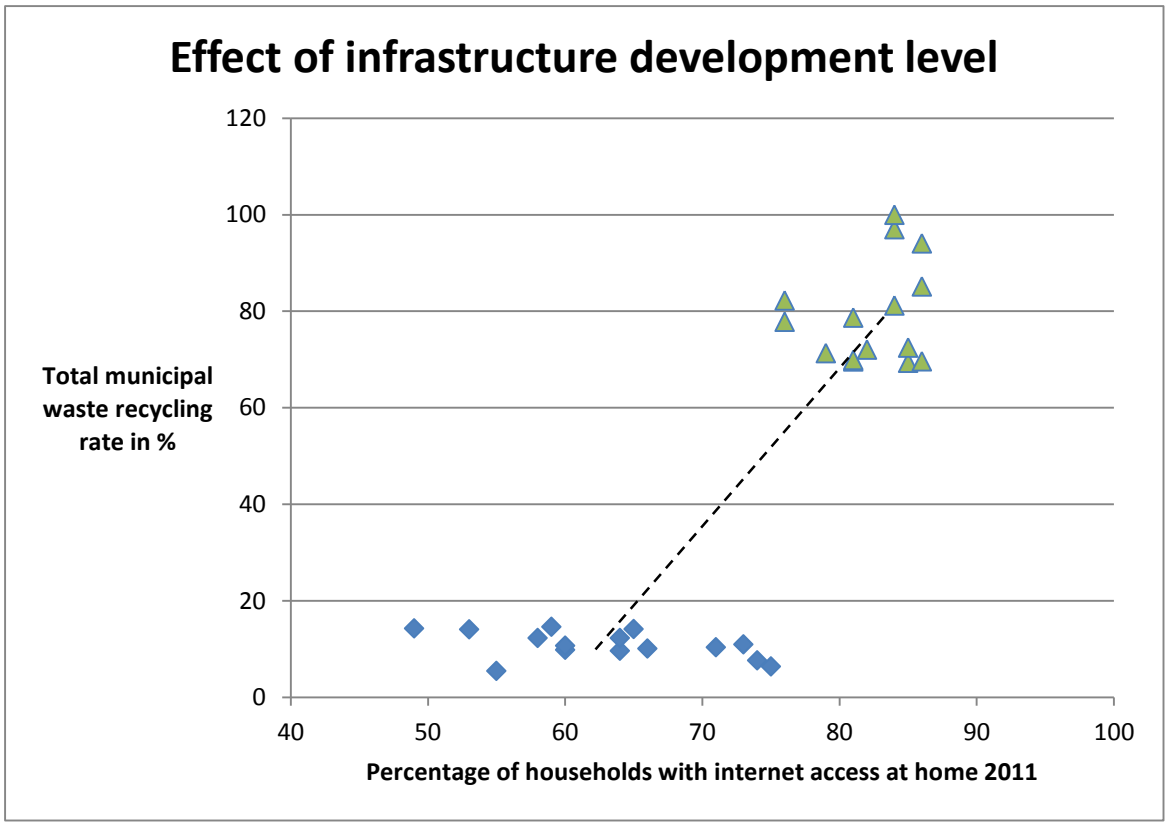
Graph 24: Effect of the total recycling rate on the crude-death-rate of 26 selected regions for the year 2011. Source Eurostat (2014)



Graph 25: Effect of poverty risk on the municipal waste total recycling rate for 20 selected regions for the year 2011 (data: Eurostat (2014))

Graph 26 shows that there is a significant correlation between the percentage of households with internet access and the recycling rate. Regions with high internet access have also a high recycling rate. This may indicate:

- that the general development of the internet and other IT infrastructure go in parallel with the development of the recycling system;
- that regions which put much emphasis in infrastructure development invest in both the recycling system and the IT-infrastructure; and/or
- that households which are active in using the latest technologies also support the recycling of municipal waste. A high share of internet access may also be correlated to the probability to have faster and free access to information on education and awareness, in this case on the importance of separation of waste before collection.



Graph 26: Effect of the share of households with direct internet access on the municipal waste total recycling rate for 30 selected regions for the year 2011 (data source: Eurostat 2014))

2.2.4. Are certain regions disadvantaged?

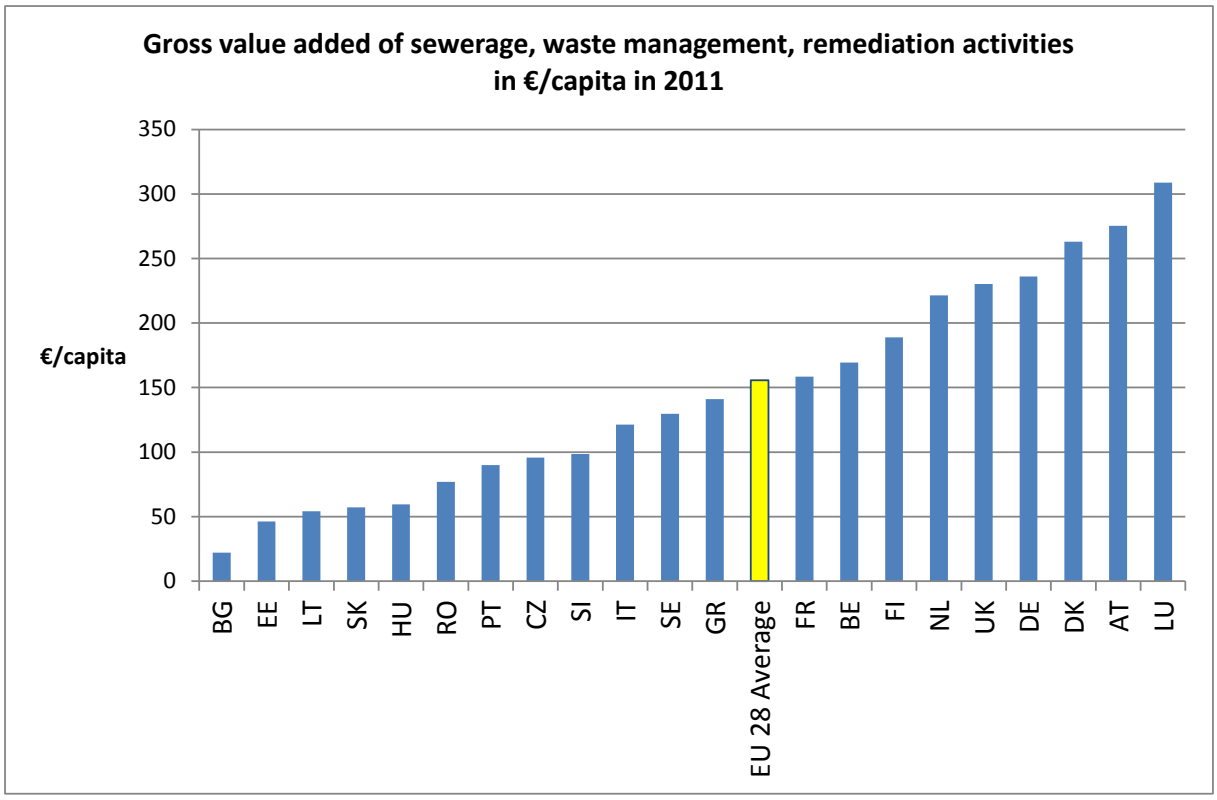
It seems that regions

- With an annual GDP of less than 20,000 €/capita.
- With low population density.
- With very high population density.
- At the eastern to south-western rim of the EU.

have more difficulties in achieving high recycling rates than more affluent, regions in the core of the EU with moderate population density.

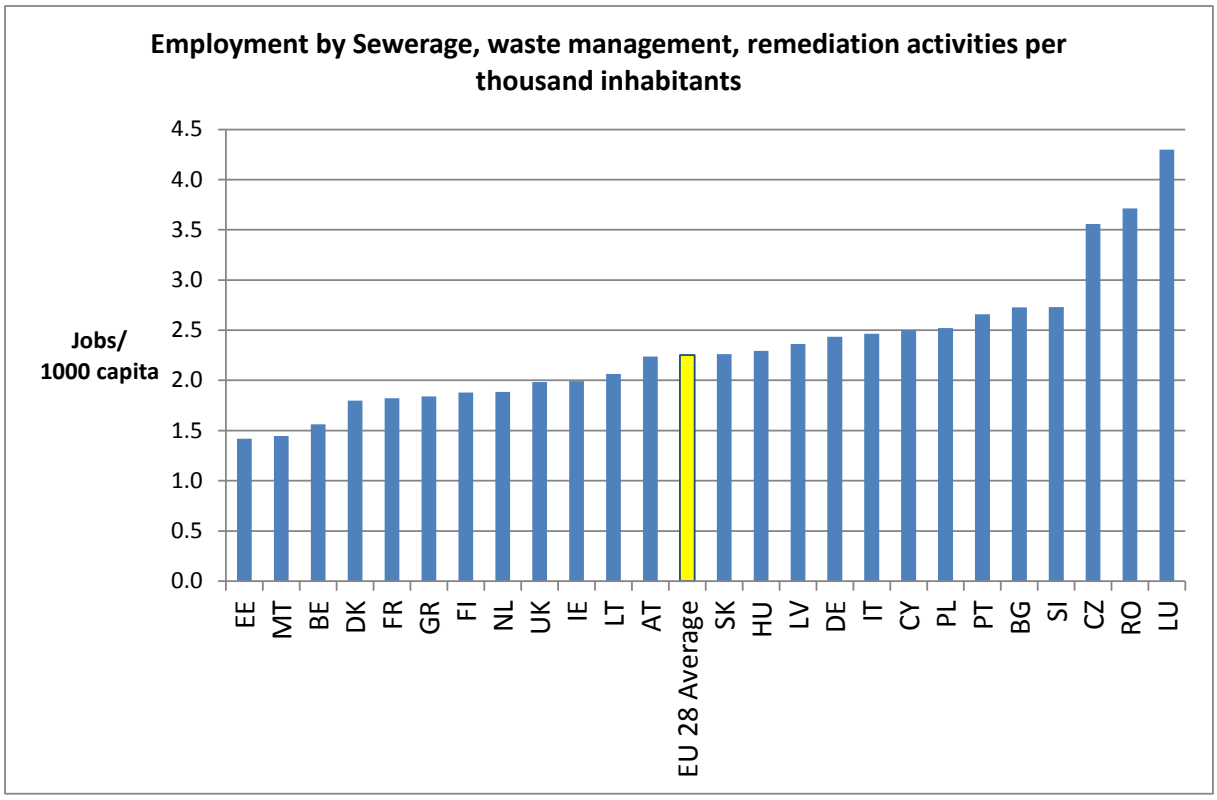
In which social, environmental, socio-economic fields is this impact manifesting itself? What is the impact on budgets and economic activity of the regions and the employment and innovation of these regions?

Graph 27 shows the gross value added of the combined sewerage, waste management and remediation sector for different EU Member States and the EU average for the year 2011. It can be seen that the waste management sector of more affluent countries such as Luxembourg or Austria show a much higher level of value creation than less affluent countries.



Graph 27: Gross value added of the combined sewerage, waste management and remediation sector for different EU Member States and the EU average for the year 2011 in €/capita (data source: Eurostat 2014)

Graph 28 shows the number of jobs the combined sewerage, waste management and remediation sector for different EU Member States and the EU average for the year 2011 per 1000 inhabitants. The picture reveals that this sector is an important employer. In the EU in 2011 some 1.14 million people were employed in the combined sewerage, waste management and remediation sector.

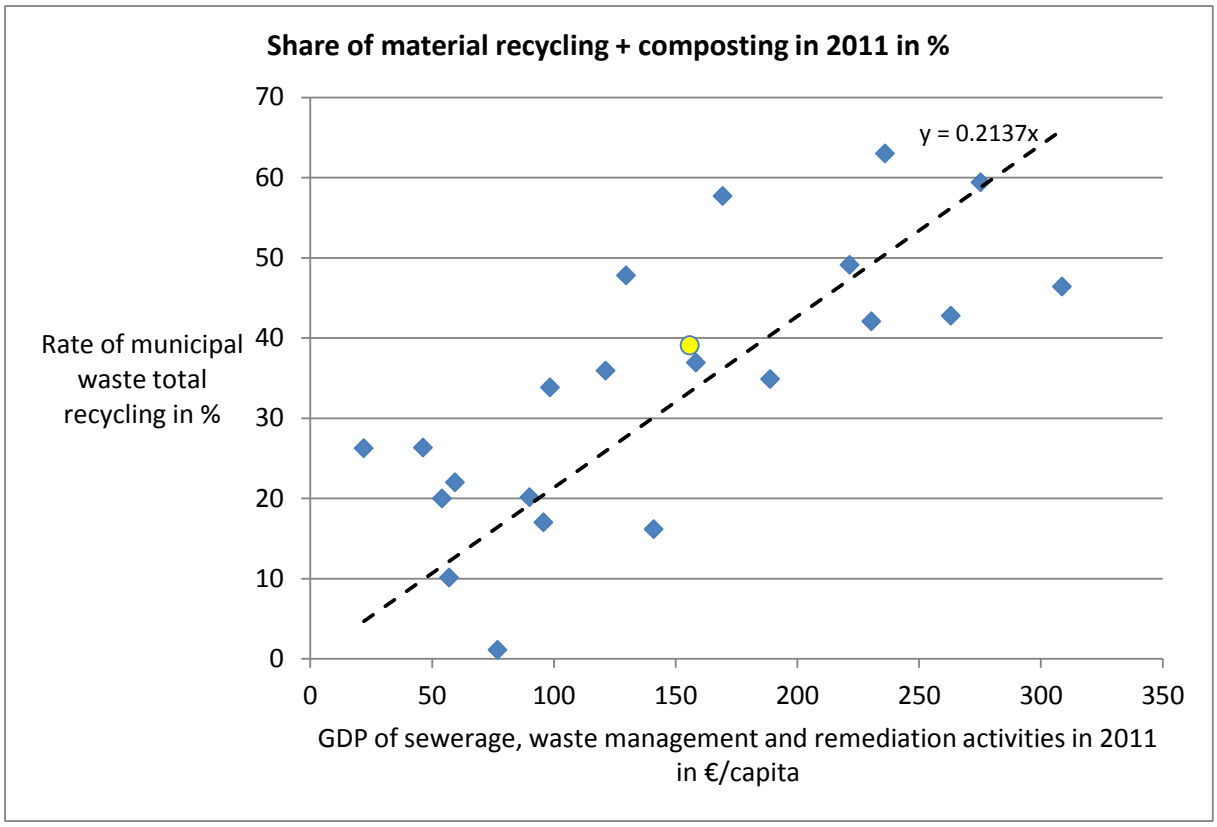


Graph 28: Number of jobs in the combined sewerage, waste management and remediation sector for different EU Member States and the EU average for the year 2011 in jobs/1000capita (data source: Eurostat 2014)

Graph 29 reveals a certain correlation between the achieved municipal waste total recycling rate and the value added of the combined sewerage, waste management and remediation sector. This correlation can be interpreted in two ways. On the one hand a higher value added can be achieved when increasing the recycling rate. On the other hand it seems necessary to increase the funds for waste management in order to achieve a higher recycling rate.

The trend-line in Graph 29 suggests that the value added by the waste management system will increase by roughly 28% when the EU as a whole achieves the 50% recycling target for municipal waste, will increase by roughly 53% to achieve a 60% target, or by 79% to achieve a 70% target. In absolute terms the trend-line suggests that the annual GDP of the the combined sewerage, waste management and remediation sector of the EU as a whole increases from approximately 79 billion € in 2011 to 101 billion € when achieving the 50 % recycling target, to 121 billion € when achieving a 60 % recycling target, and to 141 billion € when achieving a 70 % recycling target. In total the GDP of the EU waste management sector would increase by 40 billion € annually when going from the 50% to 70% target.

It is, however, unclear if this additional value is achieved by revenues from recycling material sales, or must be covered by increasing the municipal waste management tariffs.



Graph 29: Rate of municipal waste total recycling (material recycling + composting and anaerobic digestion) over gross value added of the combined sewerage, waste management and remediation sector for different EU Member States and the EU average for the year 2011 (data source: Eurostat 2014)

2.3 Outlook – Likely consequences, impacts and feasibility of the new targets proposed by the European Commission on 02.07.2014

The revised targets proposed within the Communication on Circular Economy will have different degree of applicability, feasibility and expected impacts, varying from country to country but also from region to region. In general, much will depend on the level of implementation already achieved and the "experience" with waste management. In addition, average national recycling and landfilling rates are most of the times not representative for regions, and regional potential to achieve targets can vary significantly within the same country. Furthermore, it must be also stressed that a number of Member States have not yet achieved full transposition of legislation in 2011 (as Greece, Czech Republic, Poland, Estonia, Slovakia, Slovenia and Hungary) or have not yet achieved full implementation or 100% municipal waste collection coverage, as it can be argued for all Member States still landfilling the majority of produced waste (Ernst & Young, 2011). Thus, a number of Member States are already lagging behind in the transposition and implementation of old targets, and considerable efforts are expected from these countries to catch up with waste prevention targets under EU legislation.

The Communication of the European Commission "Towards a circular economy: a zero waste programme for Europe", COM(2014) 398 proposes the following waste prevention target: "Member States shall endeavour to ensure that food waste in the manufacturing, retail/distribution, food service/hospitality sectors and households is reduced by at least 30% by 2025."

A difficulty accompanying the food waste prevention target relates to the uncertainties included in existing food waste statistics. There are no clear well defined borders between food waste and food by-products. Food waste may lose some of its water content during collection. Some food waste is also treated in home-composting. It is difficult to differentiate between food waste and other biodegradable waste, especially, but not only, in residual household waste and waste for biological treatment. It is even more difficult to differentiate between preventable and non-preventable food waste.

As a consequence:

- the methodology for determining the amount of food waste along the whole life cycle in a reliable way comparable between the countries and the reporting years;
- the reference amount for the food waste target; and
- the food waste prevention potential,

are vastly unclear.

Reisinger et al. (2011) estimated the food waste prevention potential along the whole life cycle to be 29.3%. The European Commission itself estimates the food waste prevention potential at 30% (European Commission 2014a). A target of activating the full waste prevention potential in all economic sectors in the whole of the EU in only 10 years has to be qualified as extremely ambitious.

The cost for achieving the food waste prevention target is estimated to be €17 per tonne of prevented food waste in the first year and €1.7 thereafter as part of ongoing efforts/communications etc. These cost estimates are based on data from the UK's Waste & Resources Action Programme, who have undertaken a significant amount of work on food waste prevention through their 'Love Food Hate Waste' Campaigns and the Courtauld Commitment (Hogg et al 2014c). It remains to be seen if these costs estimates are also realistic for countries with much lower per capita food waste generation.

In any case it must be taken into account that there are reasons why food wastage exists which cannot be easily removed. This might be demonstrated by the fact that the EU as a whole, or the different regions separately, have not taken advantage of the 17 € in hand savings, or the 155 € in social and

environmental benefits, which are expected to come along with each tonne of prevented food (Hogg et al 2014c).

2.3.1. The EC Impact Assessment on revised EU waste targets

The targets proposed in the European Commission's Communication on Circular Economy (COM (2014) 398) (European Commission 2014a) are accompanied by the corresponding Impact Assessment (European Commission 2014b, Hogg et al. 2014a,b,c). The main aim of this document is to assess positive and negative impacts, in terms of costs, of the implementation of the revised waste targets.

For the assessment, the document evaluates different options which correspond to the proposed targets of the Communication on Circular Economy (COM (2014) 398). Table 7 shows the proposed waste management targets for the period 2025 to 2030 for municipal and packaging waste together with existing targets from the Waste Framework Directive, the Packaging Directive and the Landfilling Directive.

It can be noticed that the European Commission in its current target review does not propose new targets in construction and demolition waste.

Table 7: The European Commission's proposals for new waste management targets from July 2014 (European Commission 2014a)

Option	**Scope of target**	**Existing targets**	**New targets**		
		For 2020 or earlier		**For 2025**	**For 2030**
Option 3.1-1	Recycling/reuse target for municipal waste	50 %	Option low	50 %	60 %
Option 3.1-2			Option high	60 %	70 %
Option 3.2	Re-use/recycling targets for packaging waste	55 %		70 %	80 %
	Maximum landfilling of biodegradable municipal waste	35 % (of 1995 level)			
Option 3.3	Maximum landfilling targets of plastic/paper/glass/metals			25 %	5 %
Option 3.4	Option 3.1-2 + Option 3.2 + Option 3.3				

The Impact Assessment (European Commission 2014b) the estimates the effects of the different options in terms of financial costs, external costs, net social costs, job creation and GHG emissions (see Table 8). The main evidences of the Summary of the Impact Assessment (European Commission 2014d, Hogg et al. 2014a,b,c)), are here briefly presented and discussed:

- The proposed target recycling rate for municipal waste seems to be derived from so called "capture rates" assumed by the impact assessment of the new recycling targets (Hogg et al. 2014b). It seems that these "capture rates" are meant to be the share of material recycled from

material contained in municipal waste by material type. It is not further explained in the supporting documents what is the basis for the assumed "capture rates". Some of these "capture rates" or recycling potentials seem to be optimistic. E.g. the assumed capture rate for plastic of 60% is more than 11% above the plastic packaging recycling rate achieved in front running Germany with its well established system for recycling plastic packaging waste. Difficulties in creating markets for recycling plastics seem to be ignored in the "capture rate".

E.g. the assumed capture rate for batteries is 90%. While 90% of the batteries identified in municipal waste may actually be recycled, only 50 to 60% of the consumer batteries placed on the market are actually identified in the municipal waste fractions (EAK 2012).

- E.g. important issues which arise when approaching high recycling rates such as "compound materials" or extensive costs for separating mixed materials (such as food in cans) seem to be missing in the considerations of Hogg et al. (2014b).
- Financial costs for increasing the recycling/reuse targets on municipal waste (option 3.1) and packaging waste (option 3.2) according the European Commission are negative. This means that the European Commission expects that the financial costs for increasing the recycling rates of municipal waste from 50 to 70%, as well as for increasing the packaging waste recycling rate from 65 to 80%, to be smaller than the costs for landfilling, incinerating or treating the waste in a mechanical-biological treatment plant.

  In the supporting document Hogg et al. (2014a) explain part of the cost savings by savings in waste collection. They argue that the more sophisticated waste collection system necessary for achieving the higher recycling rates is cheaper than the existing waste collection system. So Hogg et al. (2014a) assume that it is cheaper to collect more different waste fractions from more different bins than to collect fewer waste fractions from fewer waste bins. While in some special cases such phenomena may occur, it is very questionable if such an assumption can be applied as a general rule.

  In spite of extensive documentation of the impact assessments (Gibbs et al. 2014a,b,c, Hogg et al. 2014a,b,c) the underlying assumptions for the costs of treatment for recycling remain unclear. Especially it remains unclear which waste fractions / recycling material types were taken into account when going from a 50% recycling rate to a 70% recycling rate and if any cost adjustments have been made to account for the higher level of "dirtiness" of the waste to be treated in the 50 to 70% recycling segment than in the 0 to 50% recycling segment.

  It also appears that for the costs saved by recycling the full costs of the traditional waste treatment installations (incineration, mechanical-

biological-treatment and landfilling) were taken into account (Gibbs et al. 2014c). However, in the transition period in which the capacities existing in 2020 are still in use, only their variable costs can be saved by recycling. Moreover also in the long run, the specific costs for the treatment of waste which cannot be recycled are much higher than the specific costs of the waste treated today as smaller or more scattered plants need to be used with higher specific treatment costs.

- The social costs of the Maximum landfilling targets of plastic/paper/glass/metals (Option 3.3) are higher than the social benefits (see Table 7 above). This suggests, that this option should not be realised.
- Not much information is given on what actually needs to be done on the Member State level or the regional level to achieve these targets. Only some costs for the administration of Pay-As-You-Through residual waste collection seem to be taken into account (Gibbs 2014b). The cost of the programme which has to be implemented to realise the increased recycling targets, such as costs for information, motivation and introduction of the new legal framework, seem not to be taken into account in the impact assessment

Table 8: Estimated expected effects of the new municipal / packaging waste targets proposed by the European Commission (European Commission 2014b)

Option	**Scope of target**	Expected Effects				
		Financial costs (NPV 2014-2030) in billion € (1)	External costs (NPV 2014-2030) in billion € (2)	Net social costs (1+2)	Jobs (FTEs in 2030)	GHG (2030) in million tonnes CO2eq
Option 3.1-2	Recycling/reuse target for municipal waste - high	-8.41	-8.49	-16.91	137,585	-39
Option 3.2	Re-use/recycling targets for packaging waste	-11.2	-8.45	-19.66	107,725	-20
Option 3.3	Maximum landfilling targets of plastic/paper/glass/metals	5.64	-0.65	4.99	46,165	-13
Option 3.4	Option 3.1-2 + Option 3.2 + Option 3.3	-12.65	-13	-25.65	177,637	-44
Note: Negative financial costs = net revenues (➔ revenues are higher than the financial costs); Negative external costs = net external benefits Abbreviations: NPV = net present value, FTEs = full time equivalents, GHG = greenhouse gas emissions						

As supporting measures to achieve high recycling targets the European Commission proposes to:

- further promote the development of markets for high quality secondary raw materials, including evaluating the added value of end-of-waste criteria for specific materials;
- clarify the calculation method for recycled materials in order to ensure a high recycling quality level;

- set an aspirational target of reducing marine litter by 30% by 2020 for the ten most common types of litter found on beaches, as well as for fishing gear found at sea, with the list adapted to each of the four marine regions in the EU;
- reduce the use of lightweight plastic bags, and proposes that plastics be banned from landfill by 2025; and
- include measures regarding collection and recycling of waste containing significant amounts of critical raw materials in national waste management plans.

2.3.2. EU 2025 waste targets and impacts on incineration practices

The operational objectives proposed in the Impact Assessment document reflect the ambitions set out in the recently adopted by Council and Parliament EU's 7th Environmental Action Program (7th EAP), which include:

- − Waste generation should decline and be decoupled from GDP evolution
- − Reuse and recycling should be at the highest level feasible;
- − Incineration should be limited to waste which is not recyclable;
- − Landfilling of recoverable waste should be phased out;
- − Marine litter should be significantly reduced.

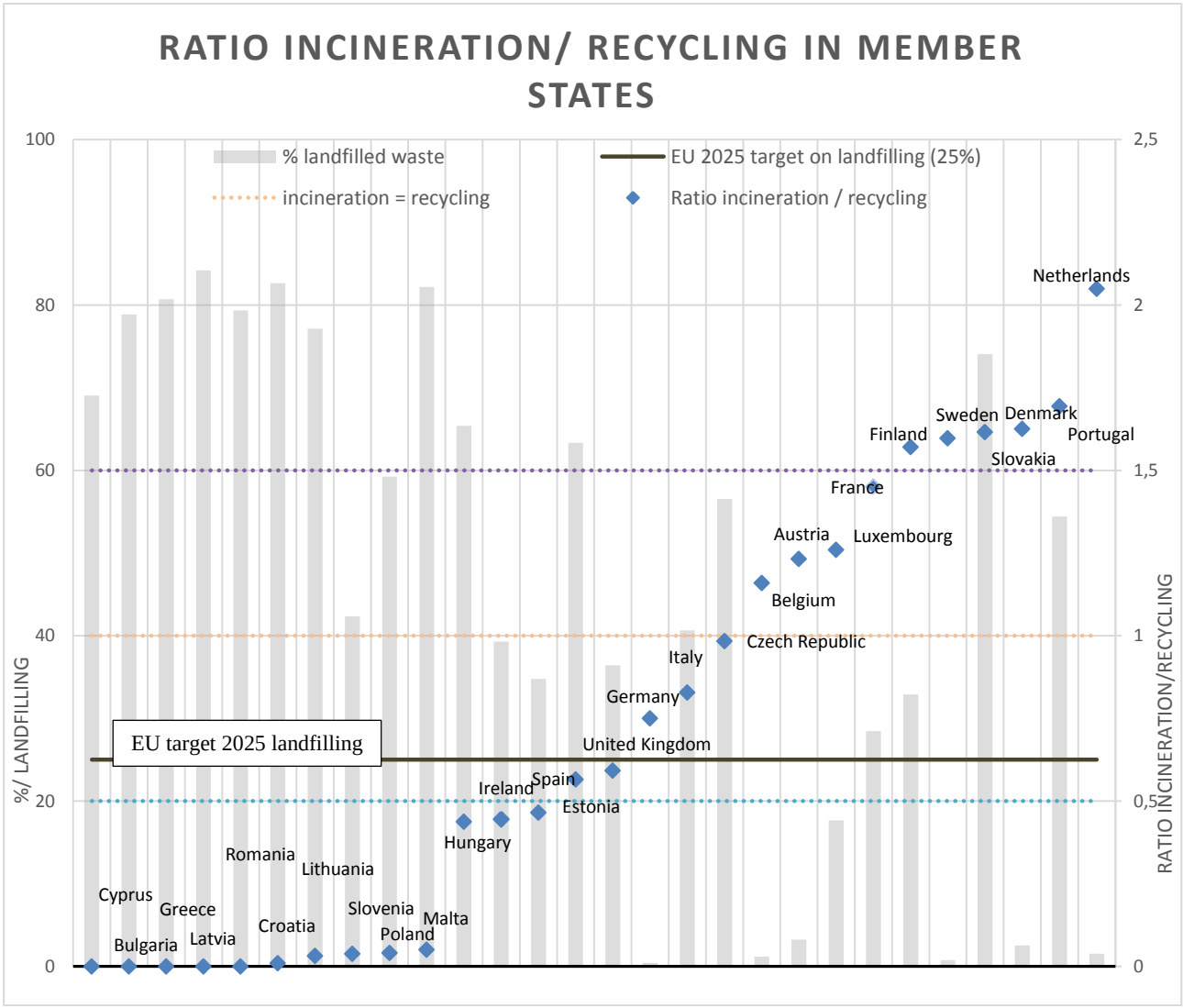
With particular reference to incineration, the targets for 2025/2030 in the new Communication on Circular Economy indirectly restrict incineration to 30%, as recycling target is set to 70%.

The graph below shows the ratio incineration/recycling of waste for each Member State, calculated based on Eurostat data 2012. The unit is represented on secondary vertical axis and ranges between 0 and 2. On the primary axis, the rate of landfilling (% on total generated waste) is represented for each Member State. The ratio values represented on secondary vertical axis has a range between 0 and 2. High ratio values indicates bigger amounts of incinerated than recycled waste, while values closed to zero stands either for very high amounts of recycled waste (which is seldom the case) or for zero amount of reported incinerated waste.

On the primary axis, the rate of landfilling (% on total generated waste) is also represented for each Member State.

Through the analysis of the graphs and existing evidences, it is possible to make some considerations on possible impacts of the new recycling, packaging waste

and landfill targets on certain types of territories, also with regard to incineration.



Graph 30: Ratio incineration / recycling of waste for each Member State. Eurostat data 2012.

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At first, four different areas can be identified in the graph:

- $r = \frac{incineration}{recycling} > 1{,}5$

The group comprises 6 Member States (Netherlands, Portugal, Denmark, Slovakia, Finland and Sweden) that prefer the adoption of incineration over recycling practices (e.g. in Portugal r =930 /549, while in Netherland the ration is higher than 2, namely r = 4518/2205 recycled thousands tons of waste). Typically, this is due either to longer tradition with incineration, recent investments in waste recovery plans, or higher economic feasibility. Interestingly, Slovakia and Portugal are still struggling with landfilling, Finland

is on a good track to reach EU 2025 target, and Sweden, Denmark and Netherlands already achieved the target.

The targets on phasing out landfilling by 2025 for recyclable (including plastics, paper, metals, glass and bio-waste) waste in non-hazardous waste landfills,– corresponding to a maximum landfilling rate of 25%, together with higher targets on packaging waste and recycling, can be expect to impact particularly countries still far away from EU targets, as Slovakia and Portugal. As these countries rely strongly on incineration, new targets could lead towards a higher demand for waste processing, which would lead in the short term to an excess of demand for existing plans, increase in transport towards incineration plants and shortage of capacity. A further analysis on Portugal regional data shows that the Lisbon region is responsible for 43 % of Portugal's incineration capacity, corresponding to 546 tons per year. [21] This is mainly done through the Valorsul power plant, a traditional mass burning incineration with three lines capable of treating approximately 662 tonnes MSW per year with energy recovery from five different municipalities[22]. Thus, the additional estimated capacity is about 18%, and could easily attract waste coming from surrounding regions, such as from Alentejo and Regiao so Centro.

- $1 < r < 1{,}5$

Member States in this group are characterized by an almost equal balance between incineration and recycling, with a slight preference for the first. Interestingly then, these are also countries that reached so far a sort of "optimum", as they either already reached the target on landfilling for 2020 and for 2025 (such as Austria, Belgium, and Luxemburg), or are on track in doing so (such as France). Especially in high density territories, the demand for incineration is driven either by lack of spaces for installing recycling plants, or by market forces. For instance in the city of Vienna the lack of demand for several recyclable plastics lead some municipalities to collect separately only plastic bottles, while other plastics were collected and incinerated together with the residual waste.

- $0{,}5 < r < 1$

In this range are Member States where recycling is preferred over incineration, namely Italy, Germany, United Kingdom, and Spain.

[21] Source: Eurostat data.

22 EUROPEAN COMMISSION DIRECTORATE-GENERAL REGIONAL POLICY DEVELOPMENT EVALUATION: EX POST EVALUATION OF INVESTMENT PROJECTS CO-FINANCED BY THE EUROPEAN REGIONAL DEVELOPMENT FUND (ERDF) OR COHESION FUND (CF) IN THE PERIOD 1994-1999 INTEGRATED SOLID WASTE MANAGEMENT IN NORTHERN LISBON, Milan Sept 2012.

These countries have some characteristics in common, first of all they are among the biggest EU countries and hosting the majority of EU population. These countries are also slowly moving towards less landfilling (with some difficulties for Spain), or already performing well (as in the case of Germany), but are nevertheless characterized by huge geographical, population density and local diversity.

In these countries, incineration does not seem to be the most feasible option, especially when this involves the transport of big amounts of waste towards incineration plants located hundreds of kilometers away from the source. Also, the implementation of local policies allowed to implement waste management systems, which in themselves were already capable to achieve EU 2025/2030 targets, such as for the region of Wales and the Greater Manchester[23], or thanks to local (such as in a number of Italian municipalities recycling beyond 80%, as reported by Legambiente in 2014[24]). In addition, it has to be noticed that with the exception of Germany, the other three countries have a 45 % share of the total amount of waste landfilled in the EU. Thus, for these countries special attention is required for incentives for recycling on a regional level by means of exchange of best practices, especially when considering the big amount of waste that still needs to be properly treated.

- $r < 0{,}5$

This group includes two subcategories. For Hungary, Estonia and Ireland recycling practices are on their way to be developed. For all other Member States where $r \approx 0$, landfilling is typically higher than 60% of their waste, and thus countries are still struggling with the implementation of waste management systems and policies in order to move away from landfilling, and do not yet have proper incineration and recycling plants. Among these, it is worth to notice that Cyprus, Greece, Croatia and Malta suffer from big variations in waste management production due to high amounts of tourists, especially during summer. Moreover, these countries account for a high number of small islands, where the construction of treatment plants could result in outcomes, which are economically and territorially not feasible (e.g. presence of natural reserves, etc.), and costly shipment is the only viable option (e.g. see Graph 6, where data indicate that Cyprus and Malta export more than 80 % of their waste). It can be assumed that tourist fluctuations can have impact on biological waste produced, packaging (e.g. food and beverages containers), and food waste from

23 Wales: 10% landfilling of municipal waste in 2020, 5%in 2025; Greater Manchester: 25% landfilling of municipal waste in 2015. Source: Weissenbach, Gradmann, Montevecchi 2013.

24 See for instance the Legambiente report 2014on recycling rates of Italian municipalities, or the plan "Recycling for Great Manchester" from Wei.

restaurants, thus impacting on many EU 2025/2030 targets. Thus, it would be important to identify those regions with a high level of income from tourism.

Eventual national bans and taxes on landfilling for these territories could produce counterproductive effects, such as illegal dumping and incineration. The New York Times reported in an article from 2008 about the situation in Greece, when the country was unable to respond to the big amount of waste that could not be landfilled. The result was an increase of illegal practices to get rid of waste, causing several deadly accidents:

"Of the blazes that killed more than 80 people in Greece last summer, several are believed to have started on illegal landfills by local people burning their trash or by methane explosions. In recent weeks, fires have broken out in dumps in the southern Peloponnese, the peninsula where the blazes last year wreaked their worst devastation".[25]

Thus, territories hit by great tourist affluence in particular times of the year, could need particular efforts to achieve EU 2025/2030 targets: measures as pay as you throw schemes could be less effective, as the resident population can be a hundreds time smaller than the fluctuant, and bans on landfilling could have serious counterproductive impacts if policies will not take into account alternative waste reduction/ prevention measures, e.g. sustainable tourism practices.

In conclusion then, it can be argued that new targets on landfill and recycling could have some side effects on incineration rates, especially with regards to:

- countries that already rely on incineration practices and are at the same time far away from reaching the EU 2020 and 2025 targets (e.g. Slovakia, Portugal). For these countries the pressure for achieving recycling and landfilling targets could lead to an increase of demand for incineration, and thus in the short term to an increase in transport towards incineration plants. Eventually, the increased demand for incineration could lead towards a shortage of incineration capacity
- Member States with established incineration practices that already reached the target on landfilling for 2020 and in many cases also for 2025, and are performing over the EU average also in terms of recycling (such as Austria, Belgium, and Netherland). These countries will most likely not feel the pressure to achieve the targets, but further demand for incineration could be driven either by lack of spaces for installing

25 Niki Kitsantonis: "Greece struggles to reduce its trash", published don New York Times on Wednesday, June 4, 2008
http://www.nytimes.com/2008/06/04/world/europe/04iht-rbogtrash.1.13452003.html?pagewanted=all&_r=0.

recycling plans, or by market forces (as the technical limitation for recycling and lack of market demand for certain plastic types). New targets in such cases could boost research to find new and innovative solutions for better recycling practices, or the implementation of local initiatives to increase awareness and education amongst citizens

- In Member States that do not have incineration plants, may not be an increase in incineration rates in the short term, (if we exclude waste exports), as typically obtaining local authority consents and construction of plants requires times. There is evidence that geographical territories, such as those in southern Europe characterized by a high number of islands (like Cyprus, Malta, Croatia, Greece, southern Italy and some regions in Spain), increased waste targets could have serious controversial impacts. Due to their particular geographical characteristics, islands can often suffer from: lack of waste treatment plans, the finances for waste shipping, economic, territorial or legal infeasibility to build new facilities and incineration plans, and big fluctuations of generated waste due to tourism in particular times of the year. The implementation of policies such as taxes on landfilling or Pay as You Throw Schemes, in combination with the listed characteristics, could lead to practices to get rid of waste by illegal landfill or incineration. This can result in negative impacts on the environment (uncontrolled landfilling and incineration can lead to release of pollutants in air, soil, and ground/surface water) and heighten concerns about the safety of the population (e.g. accidents and deaths due to uncontrolled waste incineration), and loss of natural heritage and landscape diversity due to uncontrolled fires. In addition, illegal fires can easily spread out (e.g. in summer) and cause emergency situation where the competent forces (e.g. Firemen's, Civil Protection) need to manage many factors in a short time, such as evacuation of the population and an increased demand for units.

2.3.2.1 *Further proposals by Communication COM(2014) 398*

The European Commission also proposes to reduce the administrative burden of waste management by exemptions from requirements for take-back for certain SMEs and by exempting them from the general permit or registration requirements under the Waste Framework Directive (European Commission 2014a). Such exemptions may cause considerable inequalities among the participants of the waste management system, may be a counterforce to integrating the informal unregulated parts of the waste management sector, may create different kinds of loopholes and may counteract the targets of achieving a full coverage of waste collection, achieving a full coverage of waste treatment and of increasing the recycling rates.

2.3.3. Can the targets be achieved?

The food waste prevention target of 30% is near or maybe even above the estimated food waste prevention potential. Therefore some doubt is justified whether this target can be achieved.

A municipal waste recycling rate of 70% or above has been achieved in 14 German regions and in one Belgium region. So in principle it is possible to achieve these targets. However, many other affluent regions with long traditions of up to 25 years in municipal waste collection of separate fractions and considerable investments in achieving high recycling rates have not achieved the 70 % target. The total municipal waste recycling potential in these regions seem to be much lower. It is not known where the total recycling potential for regions with a shorter recycling management history actually lies. In any case it is likely that only an increase of the general affluence of the poorer regions and a very strong government programme will be necessary to achieve the 70% target.

Graph 7 above shows that the new 80 % target for the recycling of packaging waste seems not so far away from the 63 % already achieved by the EU average in 2011. Also Belgium claims to already having achieved the level of the new target. Given the already long tradition of packaging waste collection and treatment in Germany and the intensive measures to support these systems, (such as obligatory deposit refund schemes) it is difficult to believe that the majority of the EU Member States will be able to achieve the German level of 72% packaging waste recycling, not to mention the Belgium recycling rate of 80%.

For the packaging waste targets, five Member States have already hit the 2025 target of 70% of recycling (excluding energy recovery), and sixteen other Member States have overall recycling rates above 60% already in 2011 (see Graph 6). These numbers further increase if total packaging waste recovery is taken into account (see
Graph 5), with eleven Member State having already achieved the target in 2011, and just five Member States being below 60% (e.g., the EU target for 2008). Thus, it can be argued that the overall packaging waste target has the potential to be achieved by the majority of countries. Still, although the EU as a whole seems to perform well in terms of total recycled packaging, different impacts are expected:

- Paper: reality shows that the 2025 target of 90 % is achievable, whereas some concerns are raised on the demand of the market of such an amount of recycled paper. In addition, recycling of certain materials cannot go

beyond certain amounts (not technically feasible) or exceed a certain number of cycles, as in the case of paper.

- Plastic: Generally, a low amount of plastic is recycled due to technical limitations, or lack of demand on the market (e.g. in the city of Vienna). In relation to the first issue, an increase in of research projects on recycling techniques of plastic could be expected.
- In the case of wood, a limitation could be generally low amount of wood waste in some areas and the low economic benefits from implementing wood recycling systems.
- For metal and glass waste, although some Member States have already achieved the EU 2025 targets, the question is about which options the other Member States will implement in order to achieve the target.

Thus, due to technical limitations in recycling waste (plastic, wood) and in some cases particularly unrealistic targets for some Member States, two types of impact can be foreseen. The first impact can be related to an increase in incineration practices, especially for those fractions that are highly impure, or difficult to be recycled. This is especially true for regions and territories not having of incineration plants, leading to an increase in transportation of waste streams towards regions with more capacity to recycle/recover (e.g. of unrecyclable plastic towards incinerators). On the other hand, a positive impact could derive from the application of the packaging targets, that could serve as an incentive to boost research and innovation projects in exploring advanced techniques for the recycling of certain waste types, as for instance unrecyclable plastic.

The landfilling target of 25% by 2025 has already been reached by 7 Member States. Still, it should be once again underlined that the achievement is intended at national level, whereas notably differences can exist within the regions in terms of waste management performances. Thus, the focus of these countries should be oriented towards the improvement of waste management systems at regional level.

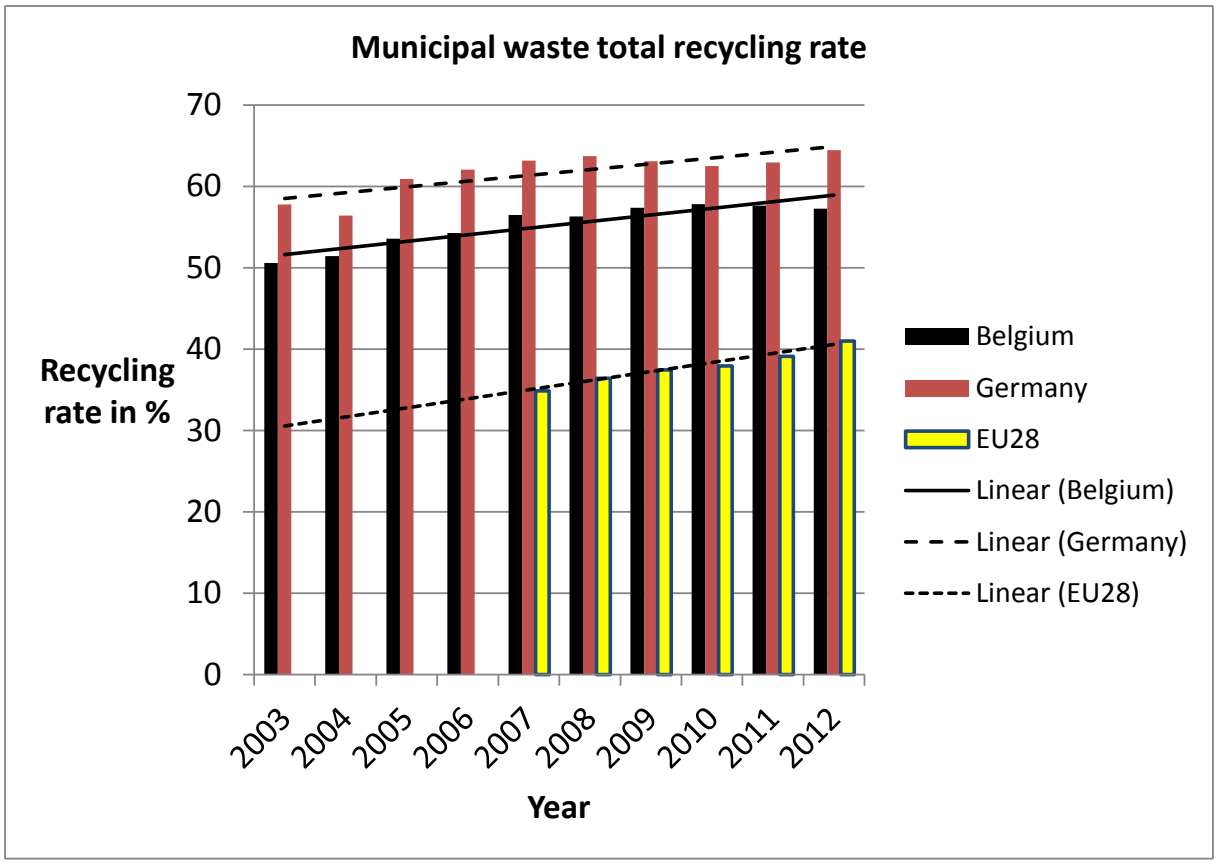
Within the Member States with landfilling rates over 25%, two groups can be identified: a first group (France, Finland, Estonia, United Kingdom, Ireland, Italy and Slovenia) with landfilling rates between 25% and 40 %. With the exception of France and Italy, the other Member States managed to halve the waste to landfill in six year (with Estonia and Slovenia reaching peaks of 65% and 56%), thus it can be argued that these Member States have the potential to achieve the EU25 target, even before 2025. Italy and France are slower and managed to decrease waste to landfill by 20% in the past 6 years, partly also due to the big amount of generated waste: in this case, UK offers a very good

example on how to manage diversion from landfilling (e.g., UK diverted 49% of waste from landfill since 2006).
The last group of Member States landfill more than 60% of their waste, with peaks of over 80% . Interestingly, the diversion of waste from landfill happened in a "softer" way, and in comparison to 2006 these countries decrease landfilling by an average of 14% (with the exception of Croatia, Slovakia and Greece that even increase waste to landfill since 2006). Following the actual trend, it is unlikely that these Member States will be able to reach the landfilling target by 2025.

2.3.4. When can they be achieved?

There is not enough historic evidence with food waste prevention to make any estimates of how long it takes to reduce food waste generation by 30% or to achieve the total waste prevention potential.

At the current growth rate, the EU-28 municipal waste recycling rate would reach the 70% target in 2035. So when applying some additional measures for accelerating the increase of the recycling rate, year 2030 seems a reasonable target year. However, it must be taken into account that the low hanging fruits are likely to have been picked first. Therefore it has to be expected that the marginal increase of the recycling rate will be slowed down at higher recycling rates. When taking the current increase of the recycling rates of Germany or Belgium (both have an increase of 0.74%/a) (see Graph 31) as typical for going from the EU-28's recycling rate of 41% in 2012 to the target value of 70% it would take till the year 2050 to reach the 70% target.



Graph 31: Historic development of the municipal waste total recycling rate in Belgium, Germany and the EU (data source: Eurostat 2014).

First feedback from Member States on revised waste targets:

First feedback from EU Member States on the Circular Economy Communication 2014/398 can be summarized as follows:

- There is general support that new clear recycling and landfilling limitation targets are set and that these new targets need to be higher than existing targets. However, it seems that a majority of the Member States believe that the targets are set too high and that they cannot be achieved by 2030. They raise concern that the 70% recycling target for municipal waste is technically not feasible or at least not without excessive costs.
- Some questions regarding the effects of the targets seem to be unanswered. Some Member States expect that an obligation for more separate collection will lead to higher costs for enterprises and municipalities. The high targets may provide a driving force for low quality recycling. It is unclear how the different frame conditions of the different Member States can be taken into account, how incentives can be provided for the countries ahead to go even further without discouraging the other countries.
- Also some Member States propose that priority is given to achieving existing targets and to implement additional measures towards this end.

- Some Member States miss qualitative targets and the objective that only toxic free materials are recycled.
- Concerns were also raised with respect to the scope of the municipal waste recycling targets. Household-waste-like waste from industries should not be excluded. It should not make a difference to the recycling target who collects the waste (a municipality or a private waste collector). Some Member States would like to have a broader scope as municipal waste has a rather small share of the overall waste. In any case the balance lines for calculating the recycling rate are unclear.
- Some Member States stress the importance of coherence between different policy fields. Some Member States are worried that the necessary monitoring of target achievement will lead to additional reporting obligations.
- In principle the proposed landfill ban is supported by some Member States. However, concerns are raised if it can be realised in practice. Some Member States request exceptions for islands. Also the question seems to be unanswered what should be done with the toxic materials removed from recycling material during waste treatment.
- The Member States' support for the proposed food waste prevention target is rather limited. Concerns were raised that this target will lead to an aggravation of the legal situation and to increased costs.

2.3.5. What is the impact on jobs?

Analysis provided by the European Commission in the Impact Assessment document offers a clear picture of the impacts of revised waste target on the EU as a whole.

Concerning jobs creation, the document evidences that more than 180.000 direct jobs related to waste management could be created by 2030, most of them impossible to delocalize outside the EU, when the option named as" 3.7" would be fully implemented in the EU (see Table 7: The European Commission's proposals for new waste management targets from July 2014 (European Commission 2014a)). The Impact Assessment document estimates that most of the jobs will be created in the larger MS having to make additional efforts to meet the existing targets (SP, PL, PT, RO, SK and CZ).

To get a feeling on the potential of job creation, in a document on recycling role in a green economy (EEA, 2011), it is evidenced how EU employment related to the recycling of materials increased by 45% between 2000 and 2007— the second largest increase of all eco-industry sub-sectors. Waste management sector has the potential to create jobs in several sectors.

At first, the employment opportunities in the recycling sector concern low-skilled work in particular, but also include medium- and high-skilled jobs, ranging from collection, materials handling and processing to manufacturing products. This could be true in particular in territories still lacking of waste management facilities, where the increased waste targets could boost the creation of jobs in the area of sorting, and collection of waste. Typically, the upper tiers of the waste hierarchy (preparation for reuse and recycling) are much more labor intensive than disposal and incineration; thus, the movement of waste up the hierarchy is generally associated with an increase in employment opportunities.

Secondly, the need to find economically and technically feasible solutions for achieving revised targets could result in the creation of high qualified jobs in the field of research and development of waste recycling technologies.

As evidenced in a study on waste related project funded within the EU 7th Framework Programme, FP7, between 2007 and 2011 at least 50 projects have been funded in the area of recycling, reuse, prevention and recovery into energy, for a total EU funding of 340 million euros (Martinuzzi, Montevecchi 2014).

This involved 714 EU institution, including universities, research institutes, but also a relevant share of industries. A gross estimation of three to four persons employed per project, gives about 2500 jobs in the field of research and development. Data reported in the paper show how half of the institution where located in Germany, followed by Spain, Italy, the United Kingdom and France. The most interesting fields of research, seems related not just to recycling technologies (as improved sorting or reprocessing), but also to industrial waste reduction and waste-to-products and waste-to-energy technologies.

In the new EU wide research & development programme, Horizon 2020, many resources are allocated for research on waste technologies through dedicated topics and call for proposals.

Finally, revised targets can also incentive the creation of jobs related to reuse, repair and upcycling (second hand markets, repair centres, etc.).

In conclusion, job creation can be expected in the area of waste collection and processing/ manufacturing sectors, in the area of research, or in the area of repairing and reuse.

2.3.6. Conclusions

Preconditions for low food waste generation are:

- a population willing to invest some time in thoroughly planning their food purchasing and sticking to their actual needs
- a population storing food properly and utilising leftovers for meals for the next day
- a food distribution system which produces its profit not by selling more food but by selling higher food quality
- a food distribution system which is willing to forward surplus-food to organisations supporting those in need
- a legal framework which enables the forwarding of surplus food while keeping high health protection standards
- a food services system which allows to adapt the portions to the actual demand
- a food supply system which can predict the next day's demand with great accuracy

Preconditions for high reuse/recycling rates

Generally a high recycling rate can be achieved

- When products are designed in a way that they can easily be recycled
- When waste products, which are difficult to recycle, are prevented
- When waste products, which would be difficult to recycle are re-used
- When different waste/material types are collected separately, and waste collection achieve full coverage
- When efficient systems for the separate collection of household waste fractions exist
- When these systems are actually used to their full potential
- When an efficient, environmentally sound system for the treatment of the separately collected fraction exists, it leads to competitive, high quality secondary materials
- When a market for these secondary materials exists.
- When consumers are aware on the importance to sort the waste they produce

Specific preconditions for high recycling rates with construction and demolition (C&D) waste are:

- Design of buildings in a way that they can be easily adapted to changing needs and the building materials easily disassembled after use
- Documentation of the building materials used
- Recycling oriented demolition (preceded by a screening of pollutants)
- Separate collection at the construction and demolition site
- Quality assured preparation of recycling materials from C&D waste

- A market for these secondary construction materials (Weissenbach 2013a).

Preconditions for low landfilling levels

Generally, Member States are already towards or beyond EU 2020 and 2025 targets.

The preconditions for low landfilling levels are:

- Achieve full coverage of waste collection
- Achieve full transposition and implementation of the EU directives
- Have implemented waste management systems that comprise a mix of recycling but also incineration practices
- Have often put in place ban and taxes on landfilling, as well as differentiated waste fees (as PAYT schemes)

2.3.6.1 *Further considerations on barriers to food waste prevention*

Key causes of unnecessary food waste generation are:

- in the household sector:
  - Lack of awareness of (1) the quantity of food waste generated individually, (2) the environmental problem that food waste presents, and (3) the financial benefits of using purchased food more efficiently
  - Lack of knowledge on how to use food efficiently, e.g. making the most of leftovers, cooking with available ingredients
  - Attitudes: food undervalued by consumers, lack of necessity to use it efficiently
  - Preferences: many (often nutritious) parts of food are discarded due to personal taste: apple skins, potato skins, bread crusts for example
  - Planning issues: 'buying too much' and 'lack of shopping planning' frequently cited as causes of household food waste
  - Labelling issues: misinterpretation or confusion over date labels is widely recognised as contributing to household food waste generation, leading to the discard of still edible food
  - Storage: suboptimal storage conditions lead to food waste throughout the supply chain, including in the household sector
  - Packaging issues: packaging methods and materials can impact the longevity of food products
  - Portion sizes: includes issues such as "making too much food" hence leading to uneaten leftovers as well as purchasing the correct portions of food; individually sized portions can minimise food waste but often create additional packaging waste

- Socio-economic factors: single person households and young people generate more food waste

- in the food service sectors:
  - Portion sizes: the one-size fits all approach to food service is a major cause of food waste. Self-service in cafeterias (consumers eat 92% of food they serve themselves) and a choice of portion size in restaurants can redress this.
  - Logistics: difficulty anticipating number of clients leads to overstocking – increased reliance on reservations can help
  - Attitudes: the practice of taking leftovers home from restaurants is not universally accepted across Europe (France for example) – strong potential to reduce restaurant food waste
  - Awareness of food waste as an issue is currently low but rising with environmental awareness as a whole
  - Preferences: school cafeterias have particular difficulty meeting preferences of schoolchildren – work to improve quality would reinforce signals to schoolchildren about the value of food
- in the wholesale/retail sectors:
  - Supply chain inefficiencies: better coordination between retailers, distributors, wholesalers and manufacturers can reduce food waste and avoid it being shifted across the supply chain
  - Stock management: difficulties anticipating demand resulting in overstocking; lack of incentive for higher accuracy in stock management due to take-back provisions in contracts with suppliers and low cost of discarding food
  - Marketing strategies: two for one deals can shift potential food waste to consumers by encouraging them to purchase more than needed – discounting of excess stock and food near expiry is preferable
  - Marketing standards: aesthetic issues or packaging defects cause some products to be rejected, although neither food quality or safety is affected
  - High product specificity: particular issues affect the longevity of specific food products (exposure to light increases in-store food wastage for example)
  - Temperature sensitivity: meat and dairy products are particularly vulnerable to temperature changes during transportation and storage, risking premature spoilage and impacting food safety
- in the food manufacturing sector
  - Food waste at this level is largely unavoidable (bones, carcasses and certain organs in meat products for example)
  - Technical malfunctions such as overproduction, misshapen products, product and packaging damage (Reisinger et al. 2011).

2.4 Conclusions and recommendations for the TIA workshop

2.4.1. Barriers which have to be addressed

Achievements of existing municipal waste collection and recycling systems suggest, that a certain regional affluence in terms of regional annual GDP of at least 20,000 €/capita is required to achieve recycling rates beyond 40%. As a consequence it may be necessary to support the general economic development of the poorer European regions, so that also in these areas higher recycling rates can be achieved.

With respect to population density both sparsely and densely populated regions seem to be hampered with respect to gaining high recycling rates. In sparsely populated areas the specific collection costs per tonne of waste collected separately may be excessive. In densely populated towns there may be spatial limitations to provide separate waste collection systems for all waste fractions of interest.

When going for higher recycling rates, it has to be taken into account that the marginal quality and thus the marginal value of recycling material decreases. The more material is collected for recycling the more "dirt" this material contains. It has to be either accepted that increasing the recycling rates provide a driving force towards downcycling or that additional cleaning steps are necessary. Therefore there is reason for doubt, that the costs for increasing the recycling rate will be fully covered by the additional revenues from sales of recycling material, compost or biogas. As a consequence an increase of the municipal waste tariffs may be a necessity.

In many cases the recycling rate is limited by the demand for recycling material. Those responsible for the construction of public buildings do not want to take the risk to be blamed for having used "waste". Only obligatory third party certified quality assurance systems based on stringent quality criteria might help to remove the "waste" image from recycling material.

An additional problem with recycling construction material arises in areas where primary construction material is abundant. Suppliers of primary material may be in the position to drive the prices down to a level where profits from recycling material are too low to be of interest.

With plastics it has to be taken into account that there are different plastic types which have to be separated for recycling. This is one of the reasons why the

majority of European recycling plastics is exported to China, where a manual separation of the different waste plastic types is cheaper than in Europe.

It also has to be taken into account that not all plastic types can be reused in a cost or energy efficient way. And even if a reuse is possible it may be in low value products. For some plastic types the potential for a repeated recycling is rather small. New technologies may improve this situation. However, research, technological development and market development need investments and take some time.

Also with paper it has to be taken into account that the level of quality is lowered in every cycle it is reused.

An increase in the recycling target may provide a pressure to accept also low quality material for composting, which may lead to the dissipation of hazardous substances in the environment.

On the whole it has to be stressed, that a high recycling target does not assure a high recycling quality. On the contrary the higher the recycling target is, the stronger is the force for recycling low quality material in low quality applications.

When going from zero per cent recycling to 100 per cent recycling there should be an optimal recycling rate which leads to the minimal environmental impact of the European economy and the minimum environmental impact of the European region. It is not known where exactly the least impact recycling rate lies. The least impact recycling rate is likely different for different waste types and is likely different for the different European regions. It is not clear if the recycling targets proposed by the European Commission lie below, or above, the least impact recycling rate.

Further barriers to high recycling rate may be:

- A single municipality is often too small to implement a complete waste prevention, collection, treatment and recycling system
- Lack of investment security
- Availability of cheap alternative treatment facilities such as MBT (mechanical biological treatment)

2.4.2. Implementation Measures

In order to achieve the recycling targets and in order to overcome existing barriers it is necessary to design a set complementing implementation measures drawing from different waste management instruments.

A distinction has to be made between instruments on national level and the level of regions with the power to introduce legal rules on the one hand and on the other hand the instruments of municipalities, which have mainly the task to implement the waste management system. The legal instruments on national and regional level cover the following instrument types: regulatory instruments, economic instruments and voluntary agreements. On municipal level the instruments focus on the improvement of separate collection and the installation of sorting and recycling capacity. Supportive instruments are awareness raising campaigns and administrative capacity building (Weissenbach 2013a).

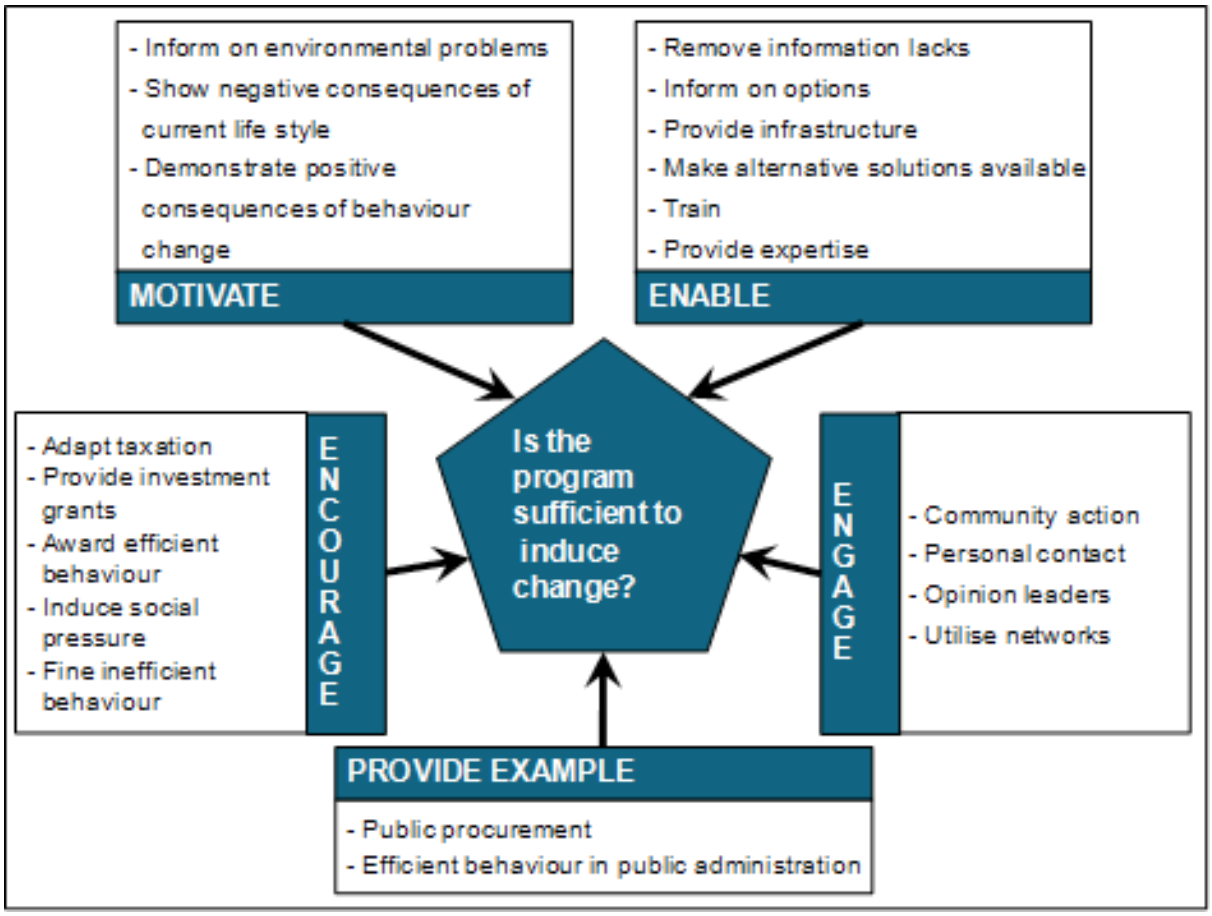
Food waste prevention measures

Behavioral change is a key vehicle for food waste prevention. Public authorities, businesses and citizens are all implicated in bringing about behavioral change. The overall aim is to shift norms in the way food in particular is produced, distributed and managed to priorities resource efficiency.

Measures which must be undertaken to achieve behavioral change can be categorized in the following way:

- Motivate: begin by addressing the values that drive behaviours. Motivating values that laud an efficient use of resources may have a more permanent and wide-reaching impact beyond the provision of information and incentives.
- Enable: provide the information, training, expertise, practical alternatives and infrastructure to make change possible.
- Engage: involve people on a community level, develop pilot projects, take advantage of existing networks, link experts, key stakeholders and thought leaders through discussion forums.
- Exemplify: lead by example by demonstrating how resource efficiency works in practice in different levels of public administration, through green procurement, use of environmental management systems, etc. The sharing of best practices in different sectors can also be helpful here.
- Encourage: stimulate resource efficient behaviour through investment grants, economic incentives, price signals, taxation, penalties, benchmarking and competitive pressure (see Graph 32).

While awareness-raising and the provision of information is crucial, food behaviors' are often entrenched at an early age, and an effective approach to behavioral change will begin by targeting young populations ('Connor et al. 2011).



Graph 32: Recommended Approach to food waste prevention (O'Connor et al. 2011).

Measures which can be applied along the whole life cycle to decrease food waste generation encompass:

- Awareness, information and motivation campaigns on food waste prevention and on nutrition, especially in schools,
- informational tools (e.g. sector specific prevention guidelines and handbooks)
- training programmes (e.g. food service staff prevention skills, waste-free cooking workshops for consumers)
- logistical improvements (e.g. stock management improvements for retailers, reservation requirements for cafeterias, ordering flexibility in hospitals)
- waste measurement activity (e.g. hands-on quantification and composition analysis of food waste by households, restaurants or schools)
- research programmes (development of new sector/product specific prevention methodologies, such as Time Temperature Indicators - A time temperature indicator being a device or smart label that shows the accumulated time-temperature history of a product. It is used on food to indicate exposure to excessive or long temperature burden)
- pilot projects on systems which allow to adapt the size of food portions to actual needs

- regulatory measures (such as separate collection of food waste requirements in Ireland)
- food redistribution programmes (diverting otherwise discarded food to charitable groups)
- removing legal barriers for food redistribution (e.g. on the liability of donators)
- standardisation of setting "use best before" and expiration dates
- development of industrial uses - turning food waste into by-products for other purposes (only one example identified – the production of fish chips from manufacturing sector fish waste, although other examples are likely to be available) (Reisinger et al. 2011.)

Measures for achieving high reuse/recycling rates

Main regulatory instruments for achieving high recycling rates are landfill and incineration bans as well as mandatory separate collection.

- Landfill ban: A landfill ban is applied to push waste treatment up the waste hierarchy. In Denmark the landfill ban is applied on combustible waste in order to increase the incineration of waste. Flanders has a broader scope and applies a landfill ban on waste, which can be prevented, recycled or incinerated. The waste management strategies of Scotland and Wales contain also plans for landfill bans, but they have not yet been implemented.
- Incineration ban: Flanders has adopted, not only a landfill ban, but additionally an incineration ban for selectively collected wastes that can be recycled (except for some high calorific wastes for renewable energy purposes) and for unseparated industrial and household wastes.
  The Scottish waste management strategy contains a provision that energy from waste treatment shall only be used to recover value from resources that cannot offer greater environmental and economic benefits through re-use or recycling.
- Mandatory separate collection: Denmark supplements the landfill ban with a mandatory separation of waste. In other countries the separate collection is supported, but not mandatory.

The economic instruments comprise mainly taxes and deposit/refund schemes. The taxes are either applied on the generation of waste or on certain treatment options, mainly landfilling, but also incineration of waste.

- Waste tax: A waste tax has been adopted in France on national level on household waste and on highly waste-generating products. This tax has the objective to prevent the generation of waste

- Landfill tax: In a number of countries (e.g. Denmark, France) a landfill tax is applied in order to divert waste away from landfilling. Also on regional level (e.g. Limerick, Clare, Kerry) a landfill tax has been adopted. The tax is applied as a single instrument, but can also be combined with a landfill ban (e.g. Denmark).
- Incineration tax: Denmark and France have also introduced an incineration tax in order to foster waste prevention, re-use and recycling.
- Packaging tax: In 2008 the Netherlands introduced a packaging tax for companies placing more than 15,000 kg of packaging onto the Dutch market. In Flanders taxes for specific packaging waste came into force in a stepwise approach: single use drinks packaging (April 2004), reusable drinks packaging (March 2007), and plastic bags, disposable cutlery, plastic clingfilm and aluminium foil (April 2007).
- Deposit/refund schemes: In addition to the packaging tax, the Netherlands have introduced a deposit/refund scheme for bottles of water, beer or soft drinks (Weissenbach et al 2013a).
- Eco-bonus-points make environmentally friendly packaging (including reusable packaging) cheaper while making high impact packaging more expensive (Schneider et al. 2014).
- General boost of the economy: Existing data suggest that municipal waste recycling rates beyond 40% can only be achieved by regions with an annual GDP of more than 20,000 €/capita. This suggests that a general boost of effluence in the poorer EU regions is necessary to achieve high recycling rate.

Almost all best-practice cases are accompanied by awareness raising and educational programmes. Topics of these programmes are waste prevention (e.g change of behaviour and lifestyles), including promotion of home composting, improvement of separate collection and information about the importance of recycling and biological waste treatment.

The means of awareness raising are very broad. Beneath the conventional distribution ways in media (newspapers, radio, TV) and with information material (flyers), the internet gains more and more importance. Websites can contain recommendations for better waste management by citizens, and can even include databases for collection points or best-practice cases. Specific education programmes are often targeted to schools and organisations. Some municipalities offer SMEs support to achieve better waste management.

The most elaborate means for distributing information about proper waste management is the employment of waste experts. Such experts may be located at the municipalities themselves or in separate “education centres”. In Flanders a

network of so-called compost masters has been established, who are responsible for giving direct support to citizens, who are interested in home composting.

Further policy instruments or other measures, which may be utilised as part of a programme to increase reuse/recycling rates, comprise:

- Voluntary agreements (In Ireland for example the sector association for farm plastics has committed itself to separately collect and recover farm plastic.)
- Support of municipalities by regional and national governments (In France financial and technical support is offered to municipalities putting in place a prevention strategy. In the late 1980s Flanders had good experience with subsidy policy for investments in recycling centres, composting plants and incinerators, and the subsidies helped stimulate these major investments in particular for (small) municipalities.)
- Establishment of door-to-door collection system for separately collected waste streams (Such collection systems have been introduced in a number of regions in Cyprus for packaging waste, and in Capannori (Italy) for separate collection of municipal waste fractions. A specific case is Copenhagen where the improved separation of C&D-waste, containing hazardous substances, has the objective to improve the quality of the recycling products.)
- Building up capacities for material recycling or biological treatment by municipalities either by direct investment or by support to other operators. Examples for infrastructure capacity building are:
  - Manchester: Materials recovery facility, mechanical biological treatment and anaerobic digestion
  - Copenhagen: Treatment plant for the recycling of C&D-waste
  - Seven municipalities in BE: Sorting centres for bulky wastes
  - Ile-de-France: Waste management and recycling centres
  - Grand Besançon: Optimisation of household waste recycling centres and development of a dismantling centre for bulky objects
  - Sweden: Anaerobic digestion for food waste
  - Cyprus: Up-to-date technological recycling facility for packaging waste
  - Austria: Agreements/ contracts with farmers, who receive subsidies for the building of composting plants.
- Set up of administrative capacity: Examples for the establishment of the necessary administrative capacity are:
  - Flemish Compost Organisation (VLACO): monitoring of the compost quality and promotion of compost sales
  - Grand Besançon: Household Waste Recycling Centres

- Limerick/Clare/Kerry: Local Authority Prevention Network (LAPN) (Weissenbach et al. 2013).

2.4.3. Consequences - Costs and benefits for the regions

The costs for achieving the 30% food waste prevention target are estimated to be €17 per tonne of prevented food waste in the first year and €1.7 thereafter as part of ongoing efforts/communications etc. This would mean initial costs of some 310 million € for the EU as a whole plus some 30 million € in all following years. These costs are expected to be offset by costs savings of 155 million € per year by reduced food and waste management costs (Hogg et al 2014c).

There is some reason for doubt that the financial costs for increasing the recycling rate are fully covered by the cost savings from more traditional waste management as expected by the European Commission. Increasing the recycling rate may not be gained for free.

Benefits include reduced emissions of greenhouse gases and pollutants, a reduced consumption of landfilling volumes and areas, and considerable job creation can be expected from the proposed new waste management targets.

The potential financial benefits from reducing the household food waste generation has been estimated to be 300 € per household per year in Austria (Schneider et al. 2012).

2.4.4. Indicators

On the basis of the lessons learnt from the evidence we have considered, a series of indicators are proposed for the development of the TIA workshop. (Annex III) Comprising waste indicators as well as ESPON QUICK SCAN indicators. These are selected in relation a regions territorial characteristics, picking up where possible also ESPON QUICK SCAN "Types of regions according to NUTS 2 statistical region", in order to ensure familiarity with the tools to the participants.

Waste indicators are also typically available from Eurostat data, or can be calculated from them. Waste management indicators are in some cases reported also at regional level. Indicators in this case can be a measure of the level of monitoring and reporting systems at national and regional level, and indirectly a measure of the potential success of "early warning" procedures, as proposed in the Communication on Circular Economy.

Secondly, the analysis of waste indicators gives indications on the applicability of certain waste management measures, such as recycling and incineration, in specific regions. In particular, recycling practices seems to have a potential of applicability strongly depending on the type of territory (rural vs. urbanized), but also due to demographic factors (highly vs. medium vs. low populated areas), geographical factors (as in the eastern and southern rim of the European Union) and economic factors (e.g. regional GDP).

The ESPON QUICK SCAN indicators can be recommended to monitor the effects of the implementation of the revised waste targets, as well as potential negative impacts in affected areas (e.g. in the islands of southern Europe, there could be an l increase in illegal landfilling and incineration practices which could have effects on the amount of pollutants released, or be related to the loss of natural heritage).

Proposed indicators can also provide a guidance to estimate impacts of the implementation of the revised targets: for instance, a high regional incineration vs. national incineration rate" can potentially indicate increase in traffic in the short-term, when more waste will need to be diverted from landfill to other available treatment plants.

Other ESPON QUICK SCAN indicators including: innovation, entrepreneurship (share of private enterprises) and access to IT services, can used to estimate the potential for improvements of the recycling sector in certain regions.

CO2 emissions from different management practices are usual indicators of impacts on climate change.

2.4.5. Important aspects recommended to be discussed at the workshop

Further aspects to be discussed at the workshop concern:

- What is a realistic food waste prevention target?
- Shall there be different recycling targets for different countries/regions in order to adapt to the different recycling potentials or would this create market distortions?
- Realistic assumptions on the costs and revenues when increasing the recycling rates
- When also poorer regions shall increase the recycling rate above 40% there effluence need to be raised to a regional GDP of above 20,000 €/capita_year.
- Sparsely populated areas (below 100 capita/km²) need good solutions for a cost efficient separate collection system

- Very densely populated areas (above 500 capita/km²) need good solutions for finding the space for the different separate waste collection bins within the household and near the houses plus an efficient alternative for home-composting
- Development of recycling markets for different plastic types
- Development of recycling markets for construction material where primary material is abundant
- What shall be the basis for the recycling rate: amount of recycling material actually reused in new products over total amount of material put on the market?
- Define recycling targets not only in terms of recycling rates but also in terms of recycling quality and numbers of cycles achieved.
- Shall SMEs really be exempt from registration and reporting obligations?

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