

Moving towards a Circular Economy Europe between Ambitions and Reality

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Contents

Executive summary	3
1. Introduction.....	4
2. Ambitions: Transition towards a Circular Economy	5
2.1 Rationale: What is a circular economy?	5
2.2 EU Package 2015: Transition towards a Circular Economy	6
3. Reality: Moving up the waste hierarchy to become more circular.....	10
3.1 Background: What is the waste hierarchy?	10
3.2 Implications of the targets on the waste hierarchy.....	11
3.3 Implications of a harmonised calculation method for Germany	19
4. The wider picture: Moving beyond waste management	22
5. Conclusions.....	25
References	26

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Executive summary

The European Commission is taking serious steps towards realising the concepts of 'recycle, repair and re-use' and avoiding waste at all stages of the value chain with its EU circular economy package (December 2015). Besides setting new recycling and landfilling targets to enforce member states to climb up the waste hierarchy, the EU Commission also intends to harmonise the measuring of recycling and re-use rates in the European Union to make more transparent, how much is effectively recycled.

Recycling of municipal waste has a long tradition in Germany, which is currently leading the EU recycling hierarchy. Only a few other countries are also on track for the new 2030 recycling targets. The United Kingdom, for instance, has undertaken huge efforts to intensify its recycling over the past decade, but many countries still need to improve further despite some positive developments in the past decade. For many member states, e.g. Romania, Slovakia and Latvia, recycling is still a foreign word. As a result, the majority of countries needs to push their recycling efforts significantly by increasing their recycling rate at higher speed until 2030 compared to the past decade. An EU-wide move towards more recycling is only realistic, if low-level recycling countries change their national waste treatment system and install a new waste management infrastructure.

A critical element in the new EU proposal is the harmonisation of the calculation method, which is combined with an implicit tightening of the targets, making it harder for all member states – including Germany – to attain the recycling targets until 2030. According to the new method Germany's current recycling rate would range between 40 and 50 per cent instead of the reported 64 per cent, because only the waste entering the final recycling process would be defined as recycled. In this case, the German recycling rate would have to increase between 0.9 to 1.6 percentage points annually until 2030. Compared to the growth of the rate during the past decade (0.3 percentage points), Germany would have to push recycling noticeably and focus on more high-quality recycling. Fortunately, the country is a role model not only for its long recycling tradition and modern waste management, but also for its global leadership in recycling technologies. Since several member states still need to change their entire system of waste treatment to comply with the EU package, this can lead to new business opportunities for German companies making and exporting circular economy-relevant technology products and services including its experience.

1. Introduction

Waste prevention and recycling are important practices to reduce greenhouse gas emissions, which are the cause of climate change. Recycling of waste can also help to reduce the huge amounts of rubbish. Besides waste avoidance and climate protection recycling is also a strategy to secure raw material supplies for the future. Businesses need to rely on secure supplies, which have to be achieved at reasonable cost. Companies increasingly face the challenge of securing reliable supplies in a world of globally increasing demand. Germany, being a country with limited natural resources, has to import almost all its metals and many other high-tech raw materials from abroad (Bardt / Kempermann / Lichtblau, 2013). According to the German Mineral Resources Agency one third of around 300 mineral raw materials and intermediate products underlie increased price and supply risks as a result of higher global supply concentrations (DERA, 2014). Besides the availability of raw materials the main reasons for supply risks are according to IW Consult (2015) geographical location, supply concentrations, vulnerability of supply conditions as well as of supply chains and price risks. Using a risk index IW Consult (2015) analyses the criticality of 45 metals and minerals. It demonstrates that only 13 raw materials are at low risk – the rest of the examined raw materials are equally divided into being at high or medium risk. The use of domestic raw materials is one way to reduce import dependence in particular of metals. Recycling is another essential strategy if economically and ecologically feasible. To a limited extent German companies can use domestically produced secondary raw materials, which were originally brought in from abroad and then recycled in Germany (Bardt / Kempermann / Lichtblau, 2013). Important sources are, for example, scraps of different materials from electrical consumer goods and ‘urban mining’, which turns urban areas into a ‘mine’ by reclaiming mineral or plastic materials, metals and wood from spent products, such as cell phones, used cars, or from buildings.

These trends are increasingly visible across Europe and lead it to reconsider the way it produces and consumes. They are triggering a move from a linear to a more circular economic model, which is restorative and regenerative by design. The EU Circular Economy Package aims to push the transition of Europe towards a circular economy. The proposal published in December 2015 takes a broader approach by not only focussing on the waste aspect but by integrating different relevant policy areas. Some EU member states are better prepared for this shift of paradigm than others, but there is no recognised way of measuring, how effective different countries undergo the transition (see EEA, 2016). This paper aims to help close this gap by evaluating the proposed targets in the waste legislatives; providing facts on the status quo of the circular economy efforts of Germany and comparing them to those of other EU member states.

2. Ambitions: Transition towards a Circular Economy

To get to a circular economy some changes are needed throughout the value chain. Chapter 2.1 explains the general idea behind a circular economy. Chapter 2.2 evaluates the most relevant points in the recently proposed EU circular economy package.

2.1 Rationale: What is a circular economy?

The rationale behind a circular economy is to keep resources in use for as long as possible. A circular economy aims to minimise both material input and waste generation by recycling and re-using products and materials and by resource-saving product design. Through recycling waste is turned into a resource. The approach is to look at the complete life cycle of a resource – from extraction to product design, production and consumption to waste management e.g. recycling. To address excess consumption of valuable resources there are in principle two ways:

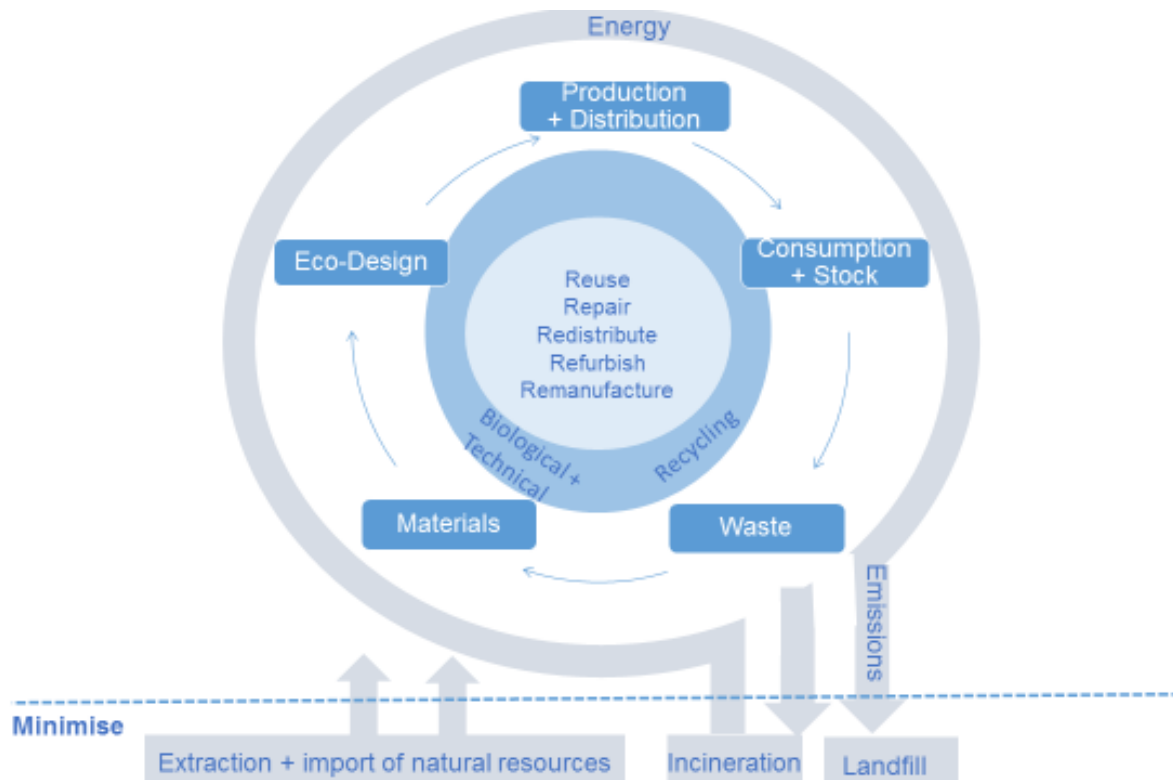
- To use less material: increase resource efficiency and waste prevention via better eco-design of products
- To use materials more than once: increase the use of secondary raw materials via improved re-use and recycling

To promote the use of recycled materials and to enable well-functioning markets for secondary raw materials, high-quality recycled products are necessary. However, high-quality recycling is not always possible under economic, technical, social and/or ecological aspects; in this case cascading use of materials should be applied. In addition, repair, refurbishment and remanufacture needs to be enforced to allow for more re-use of products and components (EEA, 2016). According to the widely used definition of the Ellen Mac Arthur Foundation a circular economy is an economy that is restorative and regenerative by design and aims to keep products, components and materials at their highest utility and value at all times, distinguishing between technical and biological cycles (EMA, 2015, p. 19). It can not only assist to achieve a lower dependence on extraction and imports, but can also reduce material losses and residuals, emissions and increases shares of recyclable resources (EEA, 2016) (Figure 1).

The process of turning into a circular economy is complex, because it is a multi-level governance challenge with actions needed by all stakeholders from European to local level. It encompasses a range of materials, products and actors as well as

different stages in product and value chains, with varying potential for circularity. To gain technological, social and organisational innovations vital for a circular economy, eco-innovations need to be enhanced.

Figure 1: Simplified model of the circular economy



Source: EEA (2016)

2.2 EU Package 2015: Transition towards a Circular Economy

The European Commission aims to trigger off a change in Europe in the knowledge that some EU countries will take longer to adapt than others. It is taking serious steps towards realising the concepts of 'recycle, repair and re-use' and wants waste to become a valuable resource with its EU circular economy package (December 2015), which consists of a legislative part and an Action Plan (see Table 1 for an overview).

European waste legislation is going to be revised considerably to get away from a linear economy of extracting, using and dumping raw materials. Substantial amendments to six pieces of EU waste legislation are planned. Besides setting ambitious targets, the EU Commission intends to change and to harmonise the measuring of recycling and re-use rates in the European Union. Only waste that is effectively recycled – the input to the final recycling process – shall be counted

towards the attainment of the recycling target. The same applies to re-used waste, which shall only be included if no further sorting or pre-processing is needed.¹

The Action Plan proposes 52 measures to ‘close the loop’ by tackling all phases in the lifecycle of a product. With its wide approach the package does not only affect the waste disposal and recycling industries. It also makes other sectors more responsible for their waste, as the two interconnected concepts of eco-design and extended producer responsibilities become more prevalent.

Since up to 80 percent of the environmental effects of a product can already be specified during the design phase, the European Commission wants companies to consider waste avoidance during the development of a product. Eco-design takes into account the environmental impact of products throughout their whole life cycle in the design phase. It aims to design products requiring the sustainable and minimal use of resources and maintaining the utility and hence the value of products, their components and materials within material cycles for as long as possible. Eco-design facilitates high-quality recycling of materials at the end of a product’s life by considering concepts of sharing, repairing, remanufacturing, refurbishing and recycling already at the design phase. In addition, cleaner material cycles can be achieved by substituting hazardous substances in products and processes (EEA, 2016).

To date, the eco-design directive only focuses on energy efficiency and excludes reparability, durability and recycling of products. An analysis of the economic and ecological consequences of the implementation measures of energy-using products by Biebeler / Mahammadzadeh (2006) shows the difficulties of realising the energy efficiency aspect. The hoped-for ecological effects have been overestimated. Attempts to save energy in standby status represent neither the best economic, nor the best ecological, approach to the problem.

Yet, it is useful to include such parameters, e.g. better possibilities of disassembly of products in these regulations. The specifications should, however, only determine efficiency goals but not specific product requirements or else competition for the best technologies and materials is unnecessarily being constrained. Sufficiently or well-functioning instruments should not be paralysed by adding more requirements. The

¹ Member States should be allowed, under strict conditions, to report recycling rates on the basis of the output of sorting facilities. Losses in weight of materials or substances due to physical and/or chemical transformation processes inherent to the final recycling process should not be deducted from the weight of the waste reported as recycled (EC, 2015b).

implementation process should be accelerated to avoid outdated standards incurring additional costs for businesses.

The legislative part of the package includes strengthened provisions around extended producer responsibility (EPR), which signifies that a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle (OECD definition). It makes the manufacturer of a product responsible for the entire life cycle of the product and especially for the collection, take-back, sorting, recycling and final disposal. This approach incentivises producers to design products that last longer and can be more easily recycled or re-used after their original use (eco-design) by internalising treatment and disposal costs. Such a responsibility may be merely financial but can be organisational as well (EC, 2014). The Waste Directive, which already implemented this concept in 2008, is revised to offer some long-overdue clarification regarding the 'rules of the game' for producers subject to national EPR laws (Morawski, 2016).

By factoring in recycling and re-use concepts in the production phase and the product itself, recycling of products shall be made easier. The Action Plan integrates different policy areas, e.g. waste and product policy, by looking at the entire product life cycle and does not only concentrate on the waste aspect. The package currently intends to use existing instruments better, e.g. the eco-design directive, and is not planning to introduce further instruments. That, however, could still change. At the moment, the Action Plan is still only a general orientation with no further concretisation and targets. The announced eco-design working plan for 2015-2017 has not been published yet and is long overdue. In addition, there are targeted activities for food, construction, industrial and mining waste and for secondary raw materials. Thus, there are still options for the EU Commission to put new ideas and proposals for further instruments on the table.

Table 1: The Circular Economy Package 2015

Brief overview

	Legislative Proposals	Action Plan
Aim	Harmonisation of the EU legislative framework on waste	Measures to "close the loop" by intending to tackle all phases in the lifecycle of a product
Contents	Amendment of six pieces of waste legislation: Waste Framework Directive, Packaging Waste Directive, Landfill Directive, Directive on electrical and electronic waste, Directive on end-of-life vehicles, Directive on batteries and accumulators and waste batteries and accumulators	The action plan complements the legislative proposal and includes an action timeline and a plan for a monitoring framework for the circular economy.
Key elements	<ul style="list-style-type: none"> • Common EU target by 2030 for recycling and re-use 65% (2025: 60%) of municipal waste / 75 % of packaging waste.² • Binding landfill target to reduce landfill to a maximum of 10% of all waste by 2030² • Ban on landfilling of separately collected waste • Promotion of economic instruments to discourage landfilling • Simplified and improved definitions and harmonised calculation methods for recycling and re-use rates • Concrete measures to promote re-use and stimulate industrial symbiosis, turning one industry's by-product into another industry's raw material • Support for recovery and recycling schemes 	<ul style="list-style-type: none"> • Actions to reduce food waste • Development of quality standards for secondary raw materials to increase the confidence of operators in the single market • Measures in the Eco-design working plan for 2015-2017 to promote reparability, durability and recyclability of products, in addition to energy efficiency • Revised regulation on fertilisers, to facilitate the recognition of organic and waste-based fertilisers in the single market and support the role of bio-nutrients • Strategy on plastics in the circular economy, addressing recyclability, biodegradability, the presence of hazardous substances in plastics • Series of actions on water reuse

Source: Own compilation of Cologne Institute for Economic Research based on Environment Council (2016)

² For Estonia, Greece, Croatia, Latvia, Malta, Romania and Slovakia the exception applies that they have five additional years to reach the targets.

3. Reality: Moving up the waste hierarchy to become more circular

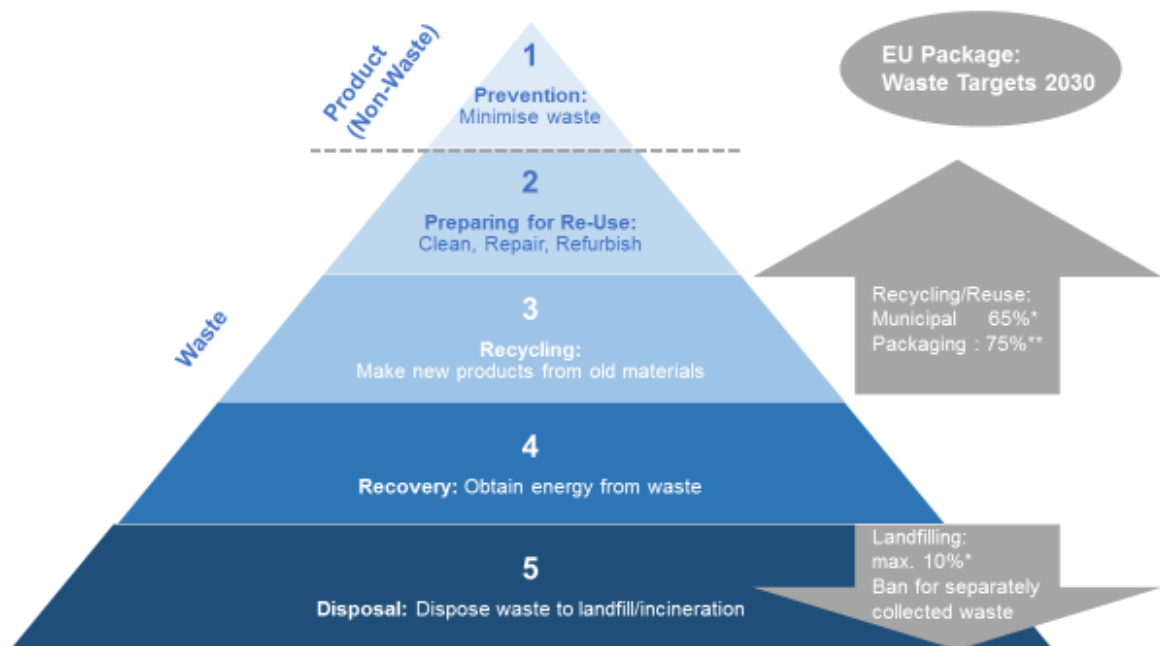
This chapter looks at the status quo of the circular economy efforts of Germany and compares them to those of other EU member states in the light of the planned amendments of waste legislation. Chapter 3.1 explains the general concept of the waste hierarchy, which is a priority in EU waste management. Chapter 3.2 looks at recent trends in EU waste treatment and the attainability of the planned targets for the different member states. Chapter 3.3 examines the implications of changing the calculation method of recycling rates for Germany.

3.1 Background: What is the waste hierarchy?

Already prior to the 2015 package, existing EU waste policies have contributed to moving towards a circular economy. There are policy measures favouring recycling and some circular economy-relevant concepts have been established (EEA, 2016). The Waste Framework Directive (2008/98/EC) sets out the basic concepts and definitions related to waste management, such as definitions of waste, recycling and recovery. It also included two recycling and recovery targets for 2020: 50 per cent of municipal waste and 70 per cent of construction and demolition waste. In addition, the waste management hierarchy became a priority for waste legislation and policy in the EU member states (EC, 2015a).

The quality of a country's waste management improves by moving up the waste hierarchy (Figure 2). As a first priority, waste should be avoided. Strictly speaking, this is not part of waste policy since it has more to do with improving manufacturing methods and influencing consumer demand. The EU Commission acknowledges this by extending its approach in the package to other policy areas. Then waste management should follow the cascade of first re-using and then recycling waste. If this is not an option waste should be used for energy recovery. As a final resort waste should be disposed of.

Figure 2: The Waste Hierarchy and the Waste Targets in the Package



* Exceptions: Estonia, Greece, Croatia, Latvia, Malta, Romania and Slovakia may obtain five additional years. In this case they have to reach a recycling/reuse rate of 60 per cent of municipal waste and a landfill rate of 20 per cent of municipal waste by 2030.

** Material specific targets for different packaging materials

Source: own illustration based on EC, 2015a

3.2 Implications of the targets on the waste hierarchy

New recycling and landfilling targets in the legislative part of the proposed package aim at getting member states to move up the waste ladder. Common EU-wide targets for recycling 65 per cent of municipal waste and 75 per cent of packaging waste by 2030 are planned. This also includes specific targets for certain materials used in packaging. The set of legislative proposals also introduces a binding target to reduce landfilling to 10 per cent of the waste stream by 2030 and a landfilling ban on separately collected waste. For five member states exceptions apply. This could be a cause of concern; diverging targets for different groups of member states could promote additional illegal waste exports and distortions of competition in the internal market. In particular, frontrunner countries with high costs such as Germany could suffer from locational disadvantages. For Germany a 65% recycling target fits together well with a national recycling target of 65 per cent for 2020 implemented in the German Recycling and Waste Management Act ('Kreislaufwirtschaftsgesetz') in 2012.

This section looks at three of the five levels of the waste hierarchy: waste avoidance as top priority, waste landfilling as lowest priority and recycling as medium priority.

3.2.1 Top priority: Waste avoidance

Highest priority in the waste hierarchy is to reduce the amount of waste generated at source and to reduce the hazardous content of waste. Waste prevention is a key element for a circular economy and is closely linked with improving manufacturing methods and influencing consumers to demand greener products and less packaging.

However, over the past decade, empirically no clear shift to producing less waste can be observed. Waste generation in the EU-28 decreased marginally between 2004 and 2012 by 1 per cent in absolute terms (to 2,514 million tonnes) and 3 per cent per person (to almost 5 tonnes per inhabitant). Total EU waste produced in 2012 was slightly higher again than in 2008 and 2010, reflecting the downturn in economic activity as a result of the financial and economic crisis (Eurostat, 2016a). The average amount of waste generated across the EU-28 in 2012 was equivalent to almost five tonnes per inhabitant. This was 3 per cent lower than in 2004. Germany contributes around 15 per cent of total waste produced in the European Union. Between 2004 and 2012 per-capita waste generated in Germany rose by 4 per cent to 4.5 tonnes, while in absolute terms total waste increased by 1 per cent to 368 million tonnes.

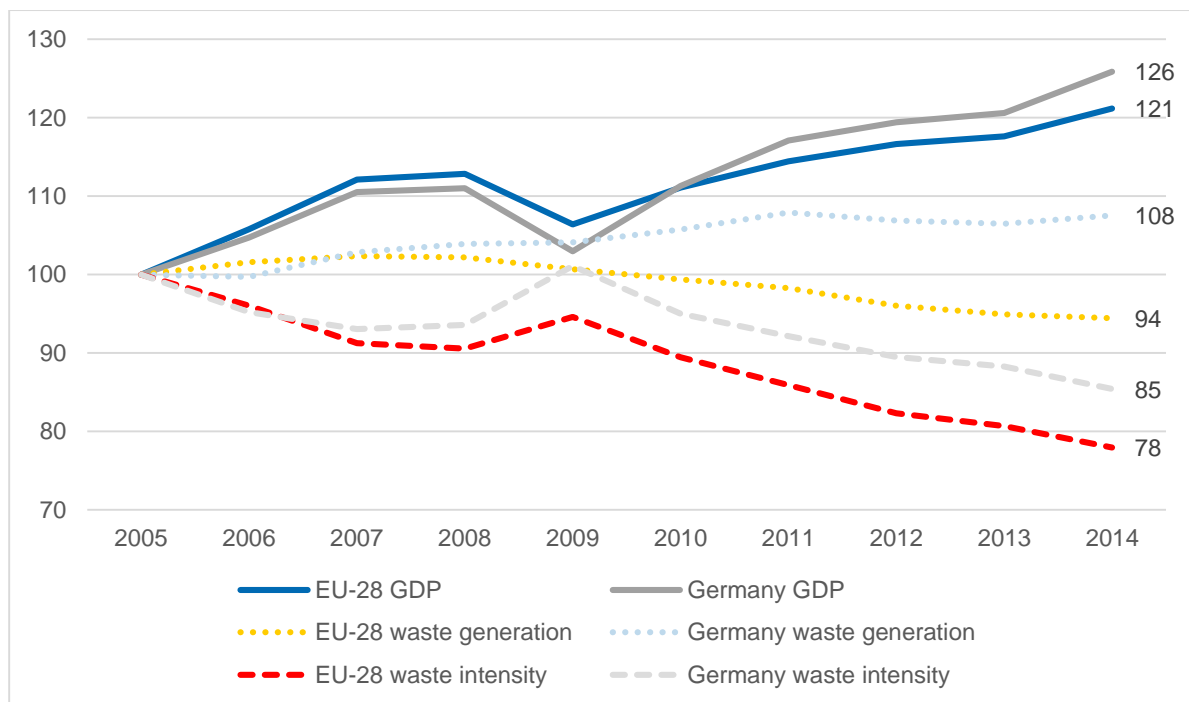
A clearer picture can be observed looking at the generation of municipal waste. Germany ranks fourth in producing municipal waste per person in the European Union. While this number increased by 9 per cent to 618 kg between 2005 and 2014, the European Union had a decrease to a similar extent (-8 per cent) to 475 kg. Within the EU-28 municipal waste generated varies considerably, ranging from 759 kg per capita in Denmark to 272 kg per capita in Romania and Poland reflecting differences in consumption patterns and economic wealth, but also in municipal waste collection and management (Eurostat, 2016b). In comparison to these figures per-head municipal waste generation in the USA and Australia are relatively high with 725 kg and 647 kg respectively (OECD, 2015).

The European Union has not really reduced the amount of total waste in absolute terms over the past decade. Yet, the European Union as a whole, as well as Germany, have been able to decouple the generation of waste from economic growth partly due to improved material efficiency. Given that material costs account for around 40 per cent of total cost, many companies have made serious efforts to

reduce the material input per unit output as a cost-cutting factor. The European Union as a whole, as well as Germany, have been able to lower the total amount of waste generated per Euro gross domestic product (GDP), the so –called waste intensity, over the past years (Figure 3). In Germany, waste intensity has decreased substantially (-15 per cent) since 2005; the EU-28 countries reduced the amount of waste generated per Euro GDP by 22 per cent during the same period. Nonetheless, countries with high GDP per capita, e.g. Germany, but also Denmark, Ireland and Austria still produce more municipal waste than countries with a low per-capital GDP.

Figure 3: Waste generation per Euro GDP has decreased

Index (2005 = 100), Gross domestic product (GDP) in PPS; total waste generation in thousands of tonnes



Source: Eurostat, 2016, own calculations

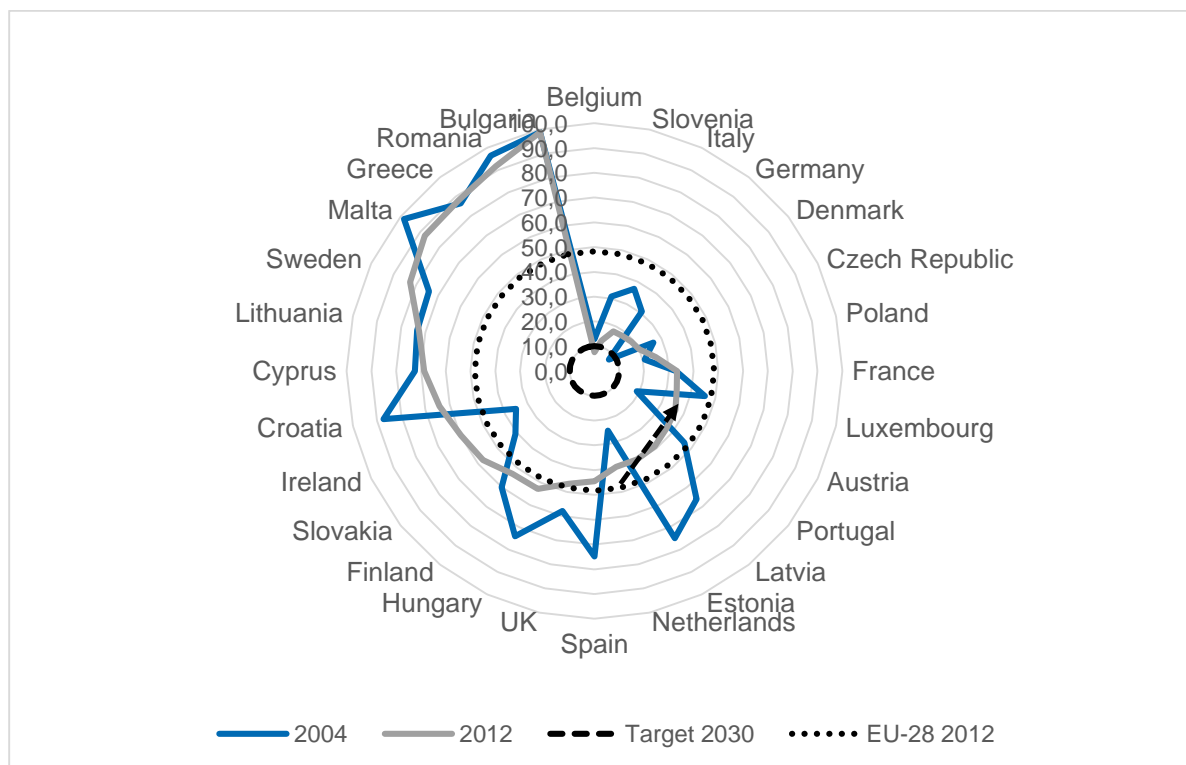
3.2.2 Lowest priority: Landfilling of waste

The European Union is slowly switching from the least preferred option of landfilling to more preferable approaches of waste treatment and there is still a long way to go. In 2012 almost half of all treated waste (48 per cent) in the EU-28 was sent to landfilling sites. A slightly lower share of all treated waste was recycled in 2012 (46 per cent). The rest was incinerated (6 per cent).

Landfilling is still a major issue to be tackled within the European Union. Landfilling rates range between 8 to 99 per cent among member states (Figure 4). Many countries are still far away from reaching the proposed target of putting a maximum of 10 per cent of their waste into landfills by 2030. Bulgaria, Romania, Greece and Malta send more than 80 per cent of their waste to such sites. Other states, e.g. Belgium (8 per cent), Slovenia (13 per cent), Italy (18 per cent) and Germany (18 per cent) have reduced their landfilling activities substantially over the past decade.

Germany has already undertaken a lot to limit landfilling by introducing a landfilling ban of untreated waste. Due to this ban, the landfill rate was reduced substantially from 31 to 18 per cent between 2004 and 2012. Recycling (2012: 69 per cent) and incineration (2012: 13 per cent) have become more important in Germany.

Figure 4: Wide variation in landfilling rates in the European Union
Landfilling rate of all waste treated in per cent 2004, 2012, EU-28



Source: Eurostat, 2016, own calculations

The trend towards less landfilling and more recycling is better visible for EU municipal waste. Between 2005 and 2014 landfilling dropped clearly in the EU-28, on average from 43 to 28 per cent. Yet, 13 member states still have a landfilling quota greater than 50 per cent. Only seven member states currently dump at the most one tenth of their municipal waste on rubbish tips. Overall, more EU municipal waste is now being recycled (32 to 43 per cent) and 21 member states have a recycling quota above 25

per cent. This is combined with an increase in incineration (19 to 27 per cent). In 2014, eleven member states incinerated more than a quarter of their municipal waste. In Germany, most of the municipal waste is being treated either via recycling (64 per cent) or incineration (35 per cent) due to a landfilling ban.

3.2.3 Medium priority: Recycling of waste

Germany is currently leading the EU recycling hierarchy. Recycling of municipal waste has a long tradition in the country. Twenty years ago, Germany already recycled two fifths of its municipal waste. By 2000, more than half of the municipal waste was already entering the recycling system. Today, this makes up two thirds of municipal waste. For most of the other EU member states the 65% target seems extremely ambitious though, since recycling rates of municipal waste vary considerably from one country to the other. Eight have recycling rates between 40 and 60 per cent and another ten countries between 30 and 40 per cent. The rest recycles less than 30 per cent of its municipal waste.

Figure 5 broadly typifies countries according to their current status (x axis: recycling rate in 2014) and their recent efforts (y axis: increase in the recycling rate between 2005 and 2014). Since European waste data is not harmonised yet, some of the data on recycled waste might include rejects from sorting and processing. Using the EU average for each indicator (recycling rate: 44 per cent, increase in recycling rate: 11 per cent), the different countries can be classified into four different types of recycling countries:

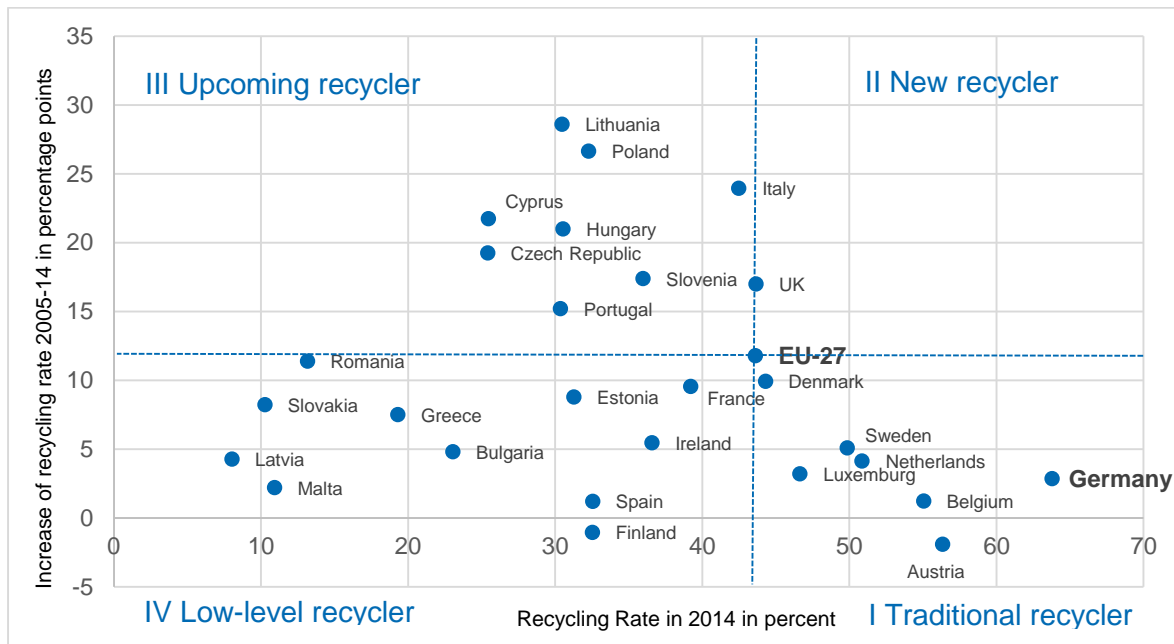
1. **Traditional recycler:** These are member states with traditionally very high recycling rates in the European Union with only minor movements in the recycling rate since 2005. This applies in particular to Germany (64 per cent), Austria (56 per cent), Belgium (55 per cent) and the Netherlands (51 per cent), but also to Sweden, Luxemburg and Denmark.
2. **New recycler:** The UK only just about fall into this category with its moderate recycling rate in 2014 resulting from major increases since 2005. Italy almost falls into this category, as they have also put a lot of effort into more recycling, but their rates are still below EU average.
3. **Upcoming recycler:** Italy is on its way into the group of new recyclers. In particular, Slovenia, but also Poland, Lithuania, Hungary, Portugal, Cyprus and the Czech Republic have made serious endeavours to increase their

recycling rates between 2005 and 2014. However, since they started off in 2005 from a fairly moderate level, their rates still lie below EU average.

4. **Low-level recycler:** The biggest group of EU countries have very low recycling rates with no significant changes since 2005. This applies in particular to Latvia, Malta, Slovakia, and Romania with recycling rates below 15 per cent but also to Greece (19 per cent), Bulgaria (23 per cent) and Estonia (31 per cent). These countries fall under the planned exception rule in the package receiving five additional years. Other countries with moderate recycling rates between 30 and 40 per cent e.g., Ireland, Finland and Spain are moving towards the EU average, but no real efforts were undertaken during the past years to increase the rate, whereas France has increased its rate by 10 per cent, which puts it just below the EU average.

Figure 5: Germany at the top of the recycling hierarchy in the EU

Recycling rate of municipal waste in per cent, 2014, change in recycling rate in percentage points, 2005-2014, EU-27 (without Croatia)



Ireland, Greece, Romania: 2013

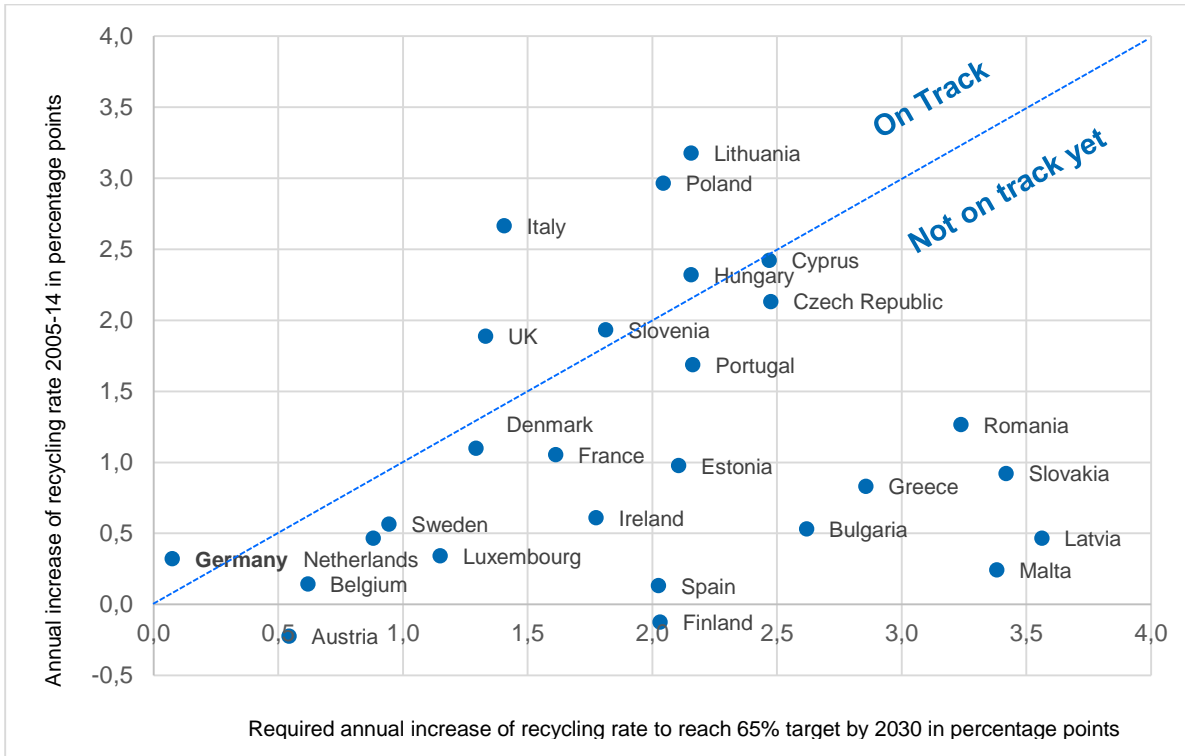
Source: Eurostat, 2016, own calculations

The goal of an EU-wide move towards more recycling can only be achieved, if the low-level recycling countries, as shown on the above mapping, change their national waste treatment system and install a new waste management infrastructure. Many countries will have to intensify their recycling efforts much more extensively than in

the past. Figure 6 plots the required annual increase of the recycling rate until 2030 starting from 2014 (x axis) with the past annual increase of the recycling rate between 2005 and 2014 (y axis).

Figure 6: Recycling target for 2030 in most cases far away

Increase of recycling rate of municipal waste required 2014-2030 (x axis) and between 2005-14 (y axis), EU-27 (without Croatia)



On track: recycling rate can grow slower than in the past decade to reach the target by 2030.
 Not on track yet: recycling rate has to grow faster than in the past decade to reach the target by 2030.
 Ireland, Greece, Romania: 2013

Source: Eurostat, 2016, own calculations

Only a few countries are on track for the 2030 recycling target. The diagonal splits them into two country groups depending on their past and required future annual increases of the recycling rate:

1. **On track:** All countries above the diagonal can increase their recycling quota at a slower rate until 2030 than during the past decade (2005 – 2014). Germany is in the best position according to the currently used recycling calculation method. Although recycling rates have not risen significantly over the past ten years, Germany is not forced to increase the rate a lot to get to the target. This is different for example for the UK, Italy, but also Poland and

Lithuania – they are all countries with major rises during the past decade and can be defined as new and upcoming recyclers. In the future, they can even slow down their recycling efforts a bit and still be able to reach the target.

2. **Not on track yet:** The majority of countries, however, are still below the diagonal and need to push their recycling efforts significantly to reach the target. This not only applies to countries, for which the European Commission is planning an exception rule, but also to, for example, Spain, Finland and Ireland.

The European Commission also plans to set a common recycling target for packaging waste (2030: 75 per cent). Currently, on average around 65 per cent of packaging waste – including possible rejects from sorting and processing – are recycled in the European Union. Yet, if rejects are omitted with the new calculation method, quotas might drop. Overall, recycling of packaging waste in the EU is more established than those of other waste streams and the target seems more attainable. Still, recycling rates of packaging waste vary substantially in the different countries. Forerunners are Belgium (79 per cent), Sweden (72 per cent), Germany (72 per cent), Netherlands (71 per cent) and Ireland (70 per cent). In particular Sweden, the Netherlands and Ireland have improved their recycling of packaging waste substantially during the past decade. Nonetheless, there are still several countries with relatively low recycling rates: Poland (36 per cent), Malta (38 per cent), Hungary (49 per cent), Latvia (51 per cent) and Greece (52 per cent).

More countries are on track to reach the planned recycling target for packaging waste than for municipal waste. The majority of countries can reach the target, even if they slow down their recycling efforts. For example, Belgium and Germany already had very high recycling rates of packaging waste in 2005 and have only gradually moved up over the past decade. Others, such as Poland would have to more than double its recycling efforts to get from the current 38 per cent to the target of 75 per cent.

The proposed circular economy package offers an important impulse towards better waste treatment, but it will be difficult to achieve all its goals. Only a few member states are on track to reach the proposed landfilling and recycling targets by 2030. Half of the treated waste in Europe is still not recovered and just dumped. Only a few countries have moved up the waste hierarchy over the past years. Leading are Germany, Austria, Belgium and the Netherlands as the only countries, who mainly recycle (recycling rate > 50 per cent) and hardly send their municipal waste to landfills (landfill rate < 10 per cent). Six more countries are gradually working towards climbing up the waste hierarchy with landfill rates below 25 per cent and recycling rate above 25 per cent. At the same time, for packaging waste more countries are

prepared to achieve the recycling target. New capacities and/or a complete restructuring of waste management are necessary in most countries. Germany already has a good recycling infrastructure but needs to enforce its efforts to reach the target, if the new calculation method is introduced. Today, according to Prognos (2016) around eleven thousand circular economy-related companies, which are companies dealing with waste collection and transport, waste recycling, waste treatment technologies and the wholesale of recycling markets, generate a turnover of more than 70 billion Euro and gross value added of 25 billion Euro in Germany.

3.3 Implications of a harmonised calculation method for Germany

Another key issue is the plan to harmonise the calculation method for recycling and re-use targets. EU member states can currently use four different methods to calculate recycling rates. Hence, a cross-country comparison can only be performed on a limited basis.

Some countries including Germany use the 'input' in the recycling process (e.g. tonnage of waste collected) as the measurement point, at which recycling is counted. This 'input' includes non-recyclable materials, which go to landfill or incineration and thus gives only a distorted picture of how much is in fact being recycled. The EU Commission proposes a method change to address this problem by moving the point of measurement to the 'output' of recovered materials – the amount of waste actually being re-used or recycled. By factoring in downstream losses, recycling rates might drop significantly for some materials, especially plastics (Morawski, 2016).

Germany currently reports a recycling rate of 64 per cent based on the described input method. According to DGAW (2016) the recycling rate drops to 34 - 38 per cent (output-based approach), if only the amount of waste is considered, that is effectively recycled and brought back into business and material cycles. Depending on materials and types of recycling operator, the actual amount of waste being recycled can vary between 10 to a staggering 90 per cent.

The European Commission's current plan to harmonise recycling measurement methods within the European Union would also have the benefit to use recycling rates, which show how much is really recycled and how much secondary raw materials are available. Besides switching to an output-based method, the approach is broader by including metal recycling for the first time. The European Commission wants to amend the definition of recycled waste in the Waste Framework Directive as (EC, 2015b, DGAW, 2016):

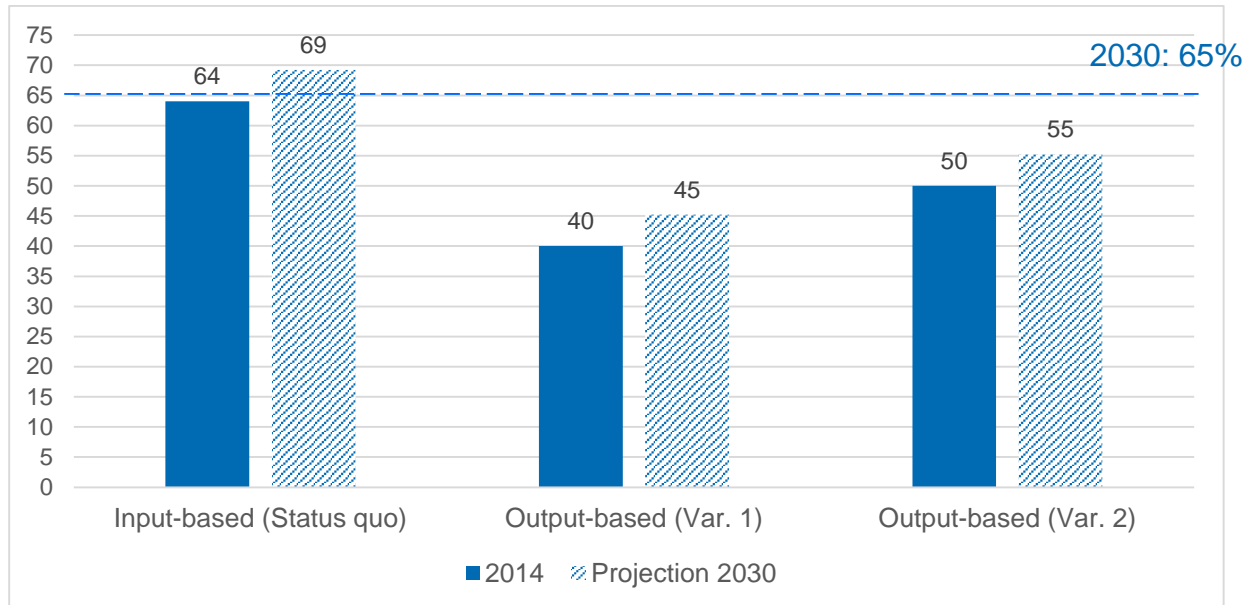
- the input entering the final recycling process,
- the input prepared for re-use after undergoing all necessary checking, cleaning and repairing to enable re-use without further sorting or pre-processing,
- the output of any sorting operation, if it is sent into the final recycling process or if it is not sent into the final recycling process less than 10 per cent are disposed or subject to energy recovery (exception from the rule),
- metals recovered from incineration ashes, if the recycled metals meet certain quality requirements.

DGAW (2016) have estimated the recycling rate for Germany according to the planned new EU calculation methods and definitions: the new recycling rate for Germany would range between 40 and 50 per cent (Figure 7):

- Without this calculation method change, Germany would have no problem to attain the recycling goal of 65 per cent in 2030. The current recycling rate, based on the input (waste collected), is 64 per cent. If the recycling rate grows at the same speed as during the past decade (2005-2014) until 2030, Germany will overachieve the target with 69 per cent.
- The European Commission currently plans to move to the new calculation method using an output-based approach after 2020. For Germany this implies that today's recycling rate would lie between 40 and 50 per cent, depending on how biological recycling processes are included. (The European Commission still needs to specify more clearly on how to deal with biological recycling processes.) If the recycling rate increases at the same rate as during the past ten years, Germany will clearly underachieve the target with recycling rates between 45 and 55 per cent until 2030. Consequently, Germany would need to intensify strongly its efforts towards more high-quality recycling.

Figure 7: Calculation methods of recycling rates for Germany

Recycling rate 2014 and 2030 (Basis: growth of recycling rate 2005-14) in per cent



Var. 1: no biological processes are included. In Var. 1 input in sorting operators, of which nearly 10 per cent are disposed or subject to energy recovery, are evaluated with 100%.

Var. 2 biological processes are included. In addition the assumption made for the definitions in var.1, in var. 2 biological input in composting or recycling operators are evaluated with 100%

Source: DGAW (2016), Eurostat (2016), own calculations

There are still some open questions regarding the proposed calculation methods and further clarifications are needed. Yet, a method change from an input-based to an output-based approach of counting waste as being recycled will have EU-wide implications on future recycling quotas and the attainment of the targets, as it is an implicit tightening of the targets. The new calculation method will make it in future considerably more difficult to fulfil the target. Hence, recent claims made by the European Parliament's Environment Committee to impose tougher recycling targets - municipal waste (70 per cent) and packaging waste (80 per cent) - are not realistic (EP, 2016).

The picture for Germany changes, too using the proposed new calculation method, as it throws the country back from attaining the recycling target. Germany would fall out from the 'being on track' group Figure 6. Until 2030, Germany would have to raise the rate by 15 to 25 percentage points. To reach the target the recycling rate would have to increase between 0.9 to 1.6 percentage points annually until 2030.

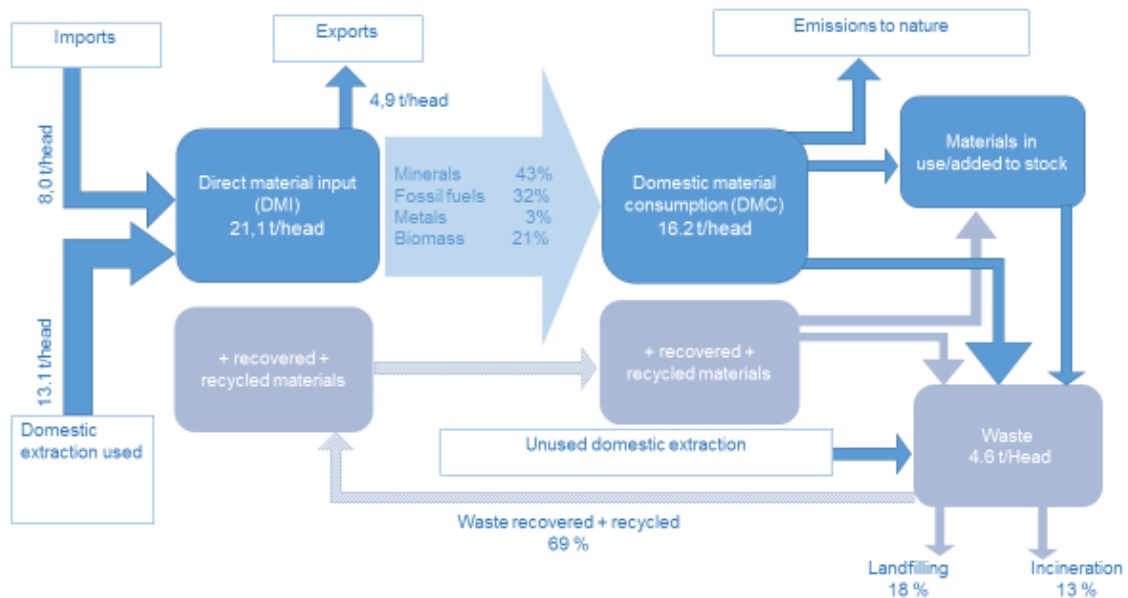
Compared to the growth of the rate during the past decade (0.3 percentage points), Germany will have to push recycling noticeably. There is no data available for other

countries according to the new method but it is assumed that the level of rates will fall accordingly in most other countries. Germany is going to keep its position as EU recycling leader. However, it needs to enforce recycling activities and to focus on more high-quality recycling. Germany has excellent prerequisites to do so with its recycling technologies and experience.

4. The wider picture: Moving beyond waste management

A circular economy is much more than managing waste. The Action Plan in the package takes a first step to integrate other relevant aspects by looking at the entire product life cycle. At this point, our current knowledge base is rather fragmented. There is no recognised monitoring or supporting tool to measure how effective the EU member states are at moving towards a circular economy. Some existing indicators are already useful, but more are needed (also see EEA, 2016 for more details). There is no good data available to monitor the main losses and sink at macroeconomic level. Figure 8 shows the discrepancy between material input, waste generation and recycling flows for Germany.

Figure 8: Circular Economy in Germany – more than waste treatment
Material flows (2014) and waste (2012) in Germany in tonnes per head



Source: own illustration for Germany based on EEA (2016)

The current situation on the data available and what conclusions can be drawn from them is as follows:

- There are established macroeconomic data on primary material inputs e.g. direct material inputs (DMI) and domestic material consumption (DMC) showing on how much material is brought into the system and used. In 2014 German direct material input amounted to 21 tonnes per head, of which eight tonnes per head were imported from abroad. Domestic material consumption was 16 tonnes per head, since five tonnes per head were exported. However, these indicators based on mass units have only limited significance, as they do not consider relevant structures and political aims, which have an impact on the consumption of resources (see Biebeler / Lang (2015 for a critical review of indicators))
- Data availability on material losses, the share of recycled materials and the sustainable sourcing of materials are very limited. The share of recycled materials in material consumption can vary substantially depending on the material. The minimisation of losses is a main feature of a circular economy. Consequently, better data would be helpful. For certain materials there is only partly information available on the share of recycled materials.
- In Germany of the waste treated, more than two thirds is presently recycled. It is unlikely that all material loops will close fully for two reasons: first, some of the processed materials are used to provide energy and are therefore not available for recycling. Second, due to increasing complexity of products and materials, e.g. plastic and metal alloys, it becomes more technically challenging to recycle.

The main ways of enhancing a circular economy are to optimise material flows by reducing material input and to use materials more than once by keeping as much of the materials within the system through recycling and re-use:

- 1) **To reduce material input:** Between 2000 and 2014 resource productivity, measured by GDP divided by domestic material consumption, increased steadily (+34 per cent) in the European Union with the exception of a dip in 2011 from 1.48 Euro/kg to 1.98 Euro/kg. Germany shows a similar trend (+29 per cent) albeit at a higher level of productivity, from 1.62 to 2.10 Euro/kg. Being a heavily industrialised country Germany obviously needs a lot of material, but uses its resources better than other industrialised member states. In comparison to the average of all 22 industrialised EU member states (gross value added by industry > 15 per cent) Germany's resource productivity is

much higher. Better eco-design, more efficient production processes, using new materials and technologies or developing new business models are ways to improve material efficiency. Germany is also at the forefront with innovations leading to reduced material use per unit of output. While one fifth of German companies had innovations leading to better material efficiency in 2008, the EU average was 12 per cent.

- 2) **To use material more than once:** Resource conversation is only possible, if there are functioning markets for secondary raw materials. Copper (42 per cent), crude steel (45 per cent) and aluminium (51 per cent) have nowadays a share of secondary raw materials of their total production between 40 and 50 per cent in Germany (BGR, 2015). For the German industry secondary raw materials have become more relevant over the past years. In 2009, every seventh tonne of raw materials used by the industry consisted of recycled materials. (IW Consult, 2010). Nonetheless, markets for secondary raw materials can still be improved in Germany. At the forefront are quality standards for recycled materials to increase confidence amongst the secondary users that the materials sourced from recycling are performing just as well as the original ones. The European Commission is planning to set quality standards to reduce the lack of information on the quality of recycled materials. Low prices for primary raw materials have made recycled materials less attractive than virgin raw materials. Yet, there are clear benefits of using recycled materials instead of primary materials as it can improve the security of raw material supplies. Another important factor is the recyclability of materials, which can be factored in when designing the product (eco-design). Eco-design is a key starting point for enhancing a circular economy, but should not be over-regulated by specific product requirements. Competition for the best technologies and materials might be otherwise limited. In 2008 one third of German companies had innovations leading to increased recycling of waste, water or materials, while the EU average amounted only to 15 per cent (CIS, 2008).

If the European Union wants to become a circular economy, the measures proposed in the Action Plan must be concretised to unlock the potential towards more resource efficiency and recyclability and to remove obstacles for developing secondary markets for raw materials. Germany has good preconditions to turn into a circular economy, yet there is still room for improvement.

5. Conclusions

The circular economy package is an important impulse for moving the European Union from a linear to a circular economy. Avoiding waste by taking the full product life cycle into account involves a complex transformation process strongly enforcing circular economy-related innovations and investments in coming years. It not only affects the waste management sector, but also extends the responsibility requirements to other sectors with the broadening of the eco-design criteria, enforced extended producer responsibilities and targeted measures for food, construction, industrial, mining waste and secondary raw materials. An extension of the eco-design directive to circular economy-relevant aspects is welcomed, but should not impose specific product requirements to ensure competitiveness for the best technologies and materials and the ability to innovate. The implementation process should be accelerated to avoid outdated standards incurring additional costs for businesses.

Solely a few countries are already on track to reach the proposed new recycling targets for 2030. In addition, the EU-wide harmonisation of recycling rates measuring methods, showing what is effectively available after the recycling process, is going in the right direction, to develop better-functioning markets for secondary raw materials. However, at the same time the method change is an implicit sharpening of the targets making it harder – also for Germany – to reach them. Germany is well-prepared for the change to a more circular economy. Yet, it also needs to enhance its recycling activities towards more high-quality recycling, better eco-design and to improve markets for secondary raw materials by ensuring sufficient quality and supply. For Germany to keep EU recycling leadership in future, further increases in efficiency and in recycling quality are required and existing successful recycling processes and related infrastructure should be preserved. This can be best achieved with market economy principles. The current discussion in Germany on re-municipalising the privately-run collection and waste management systems of packaging waste, which shall be extended to other similar materials, in the context of the planned regulation 'Wertstoffgesetz' is counterproductive, since it will impede innovations and incur additional costs to consumers (see Koppel / Neligan, 2016). Germany is a role model not only for its long recycling tradition and modern waste management, but also for its excellent recycling technologies. Eight out of ten of the globally most successful innovators in constructing waste separation systems are from Germany. In addition, German companies take globally the first four places in the technology class of plastics and plastic-based waste recycling (Koppel / Neligan, 2016). With many EU countries needing a completely new system of waste treatment to comply with the EU package, the transition to a circular economy can lead to new business opportunities for German companies making and exporting circular economy-relevant products and services including its experience.

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