The Vision of a "European Circular Economy" and the Need to Further Develop the Common European Waste Legislation

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I. New Challenges for the European Waste Sector

The first common legislative framework for waste management at the European level was the Directive 75/442/EEC on waste in 1975 (first Waste Framework Directive (WFD)). This Directive was legally justified by the approach of preventing disparities between the provisions on waste disposal which became effective in several member states during this time. It was argued that different national legislation may create unequal conditions of competition directly affecting the functioning of the common market.[1] Based on this approach, Article 100 EEC was used to develop the first harmonization of European waste legislation within the common internal market. This legal basis was chosen because of a lack of responsibility to create laws regarding environmental policy on the European level. Moreover, it was mentioned that the First Programme of Action of the European Communities on the Environment (1st EAP) stressed the need to promote harmonization of legislation.[2] Under these political provisions the first Waste Framework Directive defined

1 Directive 75/442/EEC on waste, OJ L 194 of 25/7/1975, p. 39.

2 Declaration of the Council, The Programme of action of the European Communities on the environment, OJ C 112 of 20/12/1973, p. 1.

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that "the [overall] objective of all provisions relating to waste disposal must be the protection of human health and the environment against harmful effects caused by the collection, transport, treatment, storage and tipping of waste".[3]

According to the development of the European primary law, the Waste Framework Directive was reviewed and based on the new independent competence for environmental policy at the EU-level, which was integrated into the treaties in 1986.[4] Parallel, content-related aspects of the common European waste management policy were further developed within the frame of the Environmental Actions Programmes of the Union. Furthermore, a number of waste stream specific legislation was adopted by the European institutions in the last decades.[5]

At the beginning of the last decade, a process of reviewing a number of legislative acts concerning the European waste management was initiated. Within this process the "Thematic Strategy on the Prevention and Recycling of Waste",[6] issued in the framework of the 6th Environmental Actions Programme,[7] can be recognized as the starting point for a new understanding of waste.

In this context between 2006 and 2008, the European Union revised the central legal framework for waste, namely the Waste Shipments Regulation (WSR) in 2006[8] and the Waste Framework Directive in 2008. The new Waste Framework Directive was developed with the goal of taking the entire product life cycle, from production to disposal, into account. Furthermore, a new five step priority order on waste treatment (waste hierarchy), consisting of waste prevention (priority (a)), preparing for re-use (priority (b)), recycling (priority (c)), other recovery such as energy recovery (priority (d)) and waste disposal (priority (e)), was established.[9]

Nevertheless, within the last three years the European Commission published a number of policy documents which present a new vision for waste management in Europe. In this regard the key provisions for the process of further developing EU's

3 Recital 3 of Directive 1975/442/EEC.

4 Single European Act.

5 For example Directive 1994/62/EC on packaging and packaging waste, OJ L 365 of 31/12/1994, p. 10; Directive 2000/53/EC on end-of life vehicle, OJ L 269 of 21/10/2000, p. 34; Directive 2006/66/EC on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC, OJ L 266 of 26/9/2006, p. 1 and Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), OJ L 197 of 24/7/2012, p. 38.

6 Taking sustainable use of resources forward: A Thematic Strategy on the prevention and recycling of waste, COM (2005) 666 final.

7 Decision 1600/2002/EC laying down the Sixth Community Environment Action Programme, OJ L 242 of 10/9/2002, p. 1.

8 Regulation 1013/2006/EC on shipments of waste, OJ L 190 of 12/7/2006, p. 1.

9 Directive 2008/98/EC on waste and repealing certain Directives, OJ L 312 of 22/11/2008, pp. 3-30.

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waste policy and legislation are defined mainly in two policy papers. Firstly, the "Roadmap to a Resource Efficient Europe",[10] published by the European Commission in 2011 within the framework of the Strategy Europe 2020,[11] and secondly, the proposal of a 7th Environmental Action Programme "Living well, within the limits of our planet". In June 2013, a political compromise on this new Environmental Action Programme has been reached during informal trilogue negotiations between the European Parliament, the Council and the European Commission (awaiting final adoption by the European Parliament and Council until the end of 2013).[12]

In summary it can be stated that the new interpretation of the role of waste management introduced by these two policy documents in Europe implies a three-dimensional approach: Besides the initial intension of waste management to prevent risks for human health and the environment ("environmental dimension"), a second "resource dimension" with the goal to use waste EU-wide as a resource for secondary raw materials was established. Furthermore, a third "climate dimension" with the aim to make use of the great potential to reduce greenhouse gas emissions from waste treatment activities was added.

In 2013, the European Commission initiated a broad process to review the European waste legislation. This review is guided by the overall goal to ensure coherence between the political vision of future waste management in Europe and the legislative framework, especially by taking into account the new waste hierarchy. This process includes, *inter alia*, the assessment of approaches to modernize, simplify and ensure the consistency of the waste legislation and the review of main targets included key waste directives.[13]

In this context this paper aims to bring together the political vision, the legislative framework and the empirical data of the waste sector in Europe. On this basis, approaches to further develop the specific waste-related directives of the common European waste legislation to establish a coherent framework in line with the waste hierarchy for Europe's way to a "European Circular Economy" are discussed in this article. As most of the legislation mentioned within this paper addresses municipal waste, this waste stream is the focus in the following analysis.

10 Roadmap to a Resource Efficient Europe, COM (2011) 571 final.

11 Europe 2020 – A strategy for smart, sustainable and inclusive growth, COM (2010) 2020 final.

12 See the last version of the 7th Environmal Action Programme (7th EAP), Living well, within the limits of our planet, Procedure File 2012/0337(COD) and the trilogue compromise, http://www.europarl.europa.eu/meetdocs/2009_2014/documents/envi/dv/envi20130710_7th_eap_2012-0337-cod_/envi20130710_7th_eap_2012-0337-cod_en.pdf (15/11/2013).

13 Roadmap of the European Commission, Review of Waste Policy and Legislation for 2013/2014, http://ec.europa.eu/environment/waste/target_review.htm (15/11/2013).

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II. A Political Vision for Europe's Waste Management

To develop the analytical approach of this study, this chapter will analyse the two relevant policy documents to work out the core aspects of the new understanding of waste management within the EU-policy framework until 2020.

1. The "Roadmap to a Resource Efficient Europe"

The flagship initiative for a Resource Efficient Europe[14] within the Strategy Europe 2020 describes a scenario which illustrates the need to promote resource-efficiency policy and legislation in the European Union. Moreover, it calls for a more specific analysis to define mid- and long-term objectives for a transformation towards a resource-efficient society. The intention of Communication 2011/571/EC on a "Roadmap to a Resource Efficient Europe"[15] is to provide these objectives for different elements in the area of resource-efficiency policy (e.g. sustainable use of materials, water, energy, soil, air etc.).

As mentioned in the Communication, currently each person in the European Union consumes about 16 tonnes of material annually, six tonnes of which are wasted and about 50 % of which is disposed.[16] Overall waste generation has been stable in the EU during the last years. However, some waste streams are expected to increase significantly, such as waste on electrical and electronic equipment (WEEE), which will grow by 11 % between 2008 and 2014 (around 24 kg WEEE per capita in 2012).[17] This waste contains many metals needed by Europe's high-tech industry, such as gold, copper, indium, lithium, palladium etc. (e.g. to produce mobile communication devices, batteries or solar panels). Therefore it is argued that improved recycling could satisfy at least a great part of the demand for such important metals.[18] In addition to the challenge to increase recycling rates of specific metals for high-tech products, the Roadmap points out the need to realign the policy framework in the case of waste treatment in general. For example, the fact that landfilling is still an often used method of waste treatment, even though other more sustainable methods exist, highlights the challenge for Europe's waste management sector. On the other hand, on average about 40 % of the EU's solid waste is re-used or recycled. Therefore, waste already has the function of a resource in some sectors, particularly easily-recycled materials such as steel. Concepts and technologies exist for the collection and

14 A resource-efficient Europe – Flagship Initiative under the Europe 2020 Strategy, COM (2011) 21 final.

15 COM (2011) 571 final.

16 COM (2011) 581 final, p. 2.

17 COM (2011) 571 final, p. 7 et seq.

18 Commission Staff Working Paper, Analysis associated with the Roadmap to a Resource Efficient Europe, Part II, SEC (2011) 1067, pp. 19-22.

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reprocessing of waste (some member states have an 80 % recovery-rate).[19] Nevertheless, barriers prevent much of the EU economy from expanding the re-use, recycling and recovery of valuable materials to a high quality because valuable material is lost by, for one, mixing waste streams in general waste collection and disposal.[20] Cost-effective recycling often depends on technological facilities for the separation of different valuable elements out of waste streams and their processing to obtain clean material. However, many member states are not able to provide or do not realize the need for modern facilities and technologies. Furthermore, separate collection often depends on either market actors or public authorities offering the service, and the current limits and incentives of both authorities and market actors hold back collection. Only a high quality recycling system can be the basis to increase the demand for secondary raw materials and to create a market for them.[21]

Taking all of these aspects into account, it can be concluded that the main idea behind the linkage of waste management and resource-efficiency is to use Europe's waste as secondary raw materials and to reduce the amount of extracted primary resources. To reach this goal the Roadmap introduces a guiding milestone for the further development of the European waste policy and legislation which states that:

> "By 2020, waste is managed as a resource. Waste generated per capita is in absolute decline. Recycling and re-use of waste are economically attractive options for public and private actors due to widespread separate collection and the development of functional markets for secondary raw materials. More materials, including materials having a significant impact on the environment and critical raw materials, are recycled. [...] Energy recovery is limited to non-recyclable materials, landfilling is virtually eliminated and high quality recycling is ensured".[22]

2. Provisions of the New Environmental Action Programme

Since the 1st EAP of the European Communities[23] was established in 1973, the EU uses the instrument of such programmes to develop its goals in the field of environmental policy for a specific timeframe. As already mentioned, the European institutions reached a political agreement on the text of the 7th EAP (with goals until 2020) in June 2013. In general it can be stated that the three guiding dimensions for

19 COM (2011) 571 final, p. 7 et seq.

20 SEC (2011) 1067, p. 72 et seq.

21 Ibid.

22 COM (2011) 571 final, p. 8.

23 Declaration of the Council of the European Communities and of the representatives of the Governments of the Member States on the programme of action of the European Communities on the environment, OJ C 112 of 20/12/1973, p. 1.

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the further development of the common European waste legislation are all reflected in the draft of a 7th EAP. In this regard one priority of the new Environmental Action Programme is to provide the frameworks for actions towards a low-carbon and resource-efficient economy by until 2020.[24] In line with this approach the 7th EAP states that the future waste management will have to play a key role. Therefore it underlines the aim of the Roadmap to a resource-efficient Europe to turn waste into a resource. In addition, the Environmental Action Programme clearly names the condition of a full implementation of EU waste legislation across the EU, based on strict application of the waste hierarchy.[25] In practice that will mean that energy recovery from waste is limited to non-recyclable materials and landfilling is limited to residual (non-recyclable and non-recoverable) waste.[26] Furthermore a consistent legislative framework should ensure that priority products placed on the European internal market are designed for re-use and recycling. Corresponding eco-design requirements should be implementable and enforceable.[27] All these provisions laid down in the 7th EAP have to be interpreted under the goal that all sectors of the economy will need to contribute to reducing greenhouse gas emissions.[28]

3. Analytical Approach

As a result of the analysis of the policy framework it has become clear that the resource-efficiency initiative and the 7th EAP affect a wide range of policies within the field of waste management, including, *inter alia*, methods of waste treatment, waste collection and product design. To examine possible links and approaches to ensure coherence of the new political vision and European legislation, this study will use a three-step approach:

First, an empirical set of data concerning the used methods of municipal waste treatment in the EU27 and selected member states will be developed (chapter III). This data will provide the basis to analyse existing waste legislation with the example of municipal waste.

Next, based on this data, the new Waste Framework Directive will be analysed concerning its coherence with the resource-efficiency initiative. Furthermore, it will be highlighted how the new elements of this Directive (e.g. the waste hierarchy as the core element, recycling targets, and extended producer responsibility) could be used to fulfill the provisions of the resource-efficiency initiative (chapter IV).

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24 Article 2(1b) of the trilogue compromise text of the 7th EAP, (fn. 12).

25 Annex of the trilogue compromise text of the 7th EAP, (fn. 12), no. 38.

26 Ibid., no. 41(d).

27 Ibid., no. 34.

28 Ibid., no. 31.

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Finally, in line with the goal to "review existing prevention, re-use, recycling, recovery and landfill diversion targets in order to move towards an economy based on re-use and recycling, with residual waste close to zero"[29] mentioned by the Commission in the "Roadmap to a Resource Efficient Europe", two examples of existing legislation will be analysed. For that purpose, approaches for a review of the Landfill Directive[30] (chapter V.1) and the Ecodesign Directive[31] (chapter V.2) will be examined.

III. Empirical Data

In this chapter an empirical set of data regarding the generation and treatment of municipal waste in the European Union will be developed. To measure future progress within the treatment of waste in the EU, the working staff document of the "Roadmap to a Resource Efficient Europe" proposes three relevant indicators regarding methods of waste treatment:

I. Landfill rate;

II. Overall recycling rate;

III. Total waste generation.[32]

Keeping in mind the Communications analysed above, it seems clear that it is necessary to decrease values of indicators I and III and to increase values of indicator II to reach a higher level of resource-efficiency in general. Data used in this study is provided by Eurostat. To guarantee comparability, all data (if available) is given in kg as well as in percentage per inhabitant.

1. EU's Municipal Waste

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 collected by the municipality.[33] The amount of waste collected by the municipality may vary from municipality to municipality and from country to country, depending on the local waste management system. Eurostat provides data for the generation and treatment of municipal waste in the EU27 from 1995 to 2010. To ensure comparability of data on the common European level and member states, examples for

29 COM (2011) 571 final, p. 3.

30 Directive 1999/31/EC on the landfill of waste, OJ L 182 of 16/7/1999, p. 1.

31 Directive 2009/125/EC establishing a framework for the setting of ecodesign requirements for energy-related products, OJ L 285 of 31/10/2009, p. 10.

32 SEC (2011) 1067, p. 72 et seq.

33 Ibid.

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this study are taken based on specific criteria. The examples should include "old" (membership before 2004) and "new" (membership after 2004) member states and they should represent the different geographical regions of the European Union. Taking these criteria into account, the following eight countries are considered: Sweden and Estonia (as a Northern old and a Northern new member, respectively), Germany and the Netherlands (as Western countries, noting that there does not exist a new member state in Western Europe and that parts of Germany used to be a former Eastern country), Spain and Greece (Southern countries) and Poland and Romania (new members from Eastern Europe). The election of these eight member states should roughly reflect the differences of generation and treatment of municipal waste within the EU27. A more detailed analysis could also highlight geographical and climate aspects. To show trends in EU's waste treatment, the nine tables in the Annex show data on the overall generated municipal waste and the amount of waste which was generally treated. Furthermore, the tables provide data for four different ways of waste treatment: landfilling, incineration, material recycling and composting (all data in kg per capita and percentage for the years 1995, 2000, 2005 and 2010).

2. Municipal Waste Generation and Treatment

To structure the following data analysis, the new five step waste hierarchy, introduced in 2008, functions as a starting point. The implications and legal status of the hierarchy will be analysed in detail in chapter IV. According to the categories of the hierarchy, the data analysis of waste treatment is separated into priority (e) waste disposal such as landfilling or incineration, priority (c) material recycling and composting and priority (a) waste prevention which is connected to the overall generation of municipal waste.[34] In addition, the presented data categories will be linked to the three proposed indicators to measure progress towards more resource-efficiency in Europe's waste management.

a) Landfill Rates[35]

Regarding indicator I (landfill rate), the EU's "Roadmap to a Resource Efficient Europe" defines a clear goal: "Landfilling is virtually eliminated" [36] by 2020 as quoted

34 It has to be mentioned that the analysed data shows no distinction beteween waste incineration as disposal or recovery operation. That discussion is part of the analysis in chapter IV.2.

35 "Landfill is the deposit of waste into or onto land. It includes specially engineered landfill sites and temporary storage of over one year on permanent sites. The definition covers both landfill in internal sites, i.e. where a generator of waste is carrying out its own waste disposal at the place of generation, and in external sites". Definition from Eurostat, http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Main_Page (15/11/2013).

36 COM (2011) 571 final, p. 8.

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in the introduction. Furthermore, within the five-step waste hierarchy, landfilling as a type of disposal (priority (e)) is categorized as the worst option of waste treatment.[37] The landfill rate in the whole EU27 in 1995 constituted 62 % of the generated municipal waste and shows decisively that landfilling was earlier the preferred way of waste treatment. This rate declined constantly until 2010. However, 37 % of overall generated municipal waste was still landfilled by the EU27 in 2010. Even so, data on the different member states in the Annex shows extremely heterogeneous rates for the use of landfilling as a method of treatment. For example, three member states, namely Sweden, Germany and the Netherlands, were able to reduce the amount of landfilled waste from a range of 30 % to 40 % in 1995 to virtually 0 % in 2010. Estonia and Poland also reduced their landfill rates significantly from 100 % in 1995 to around 60 % in 2010. On the other hand, the amount of landfilled waste remained stable and high in Spain (between 50 % and 60 %) as well as in Greece and Romania with rates of about 80 % in 2010. Overall, the presented data for landfilling in the EU27 and the eight member states reveals three main facts: it is possible to eliminate landfilling as a method of waste treatment, the averaged amount of landfilling within the EU27 declined significantly but remains on a high level and a number of member states use landfilling as their main waste treatment method.[38]

b) Incineration Rates[39]

The method of waste incineration is not named explicitly by the indicators of the EU's resource-efficiency strategy. In contrary to landfilling, incineration of waste can be classified as waste disposal (priority (e)) or recovery (e.g. energy recovery – priority (d)) of the waste hierarchy.[40] Data presented here does not differentiate between these two possibilities but the borderline between priority 4 and 5 will be elaborated in chapter IV. In contrast to the reduced rates of landfilled waste in the EU27, the quota of incineration of municipal waste increased steadily from 14 % in 1995 to 22 % in 2010. By interpreting the data of single member states it is evident that the three countries which reduced their landfill rates to zero exhibit an increasing amount of incinerated waste within the considered timeframe. In Sweden, the incineration rate went up from 38 % to 49 %, in Germany from 16 %

37 Article 4(1) of Directive 2008/98/EC.

38 See Annex 1 for landfill rates of the eight chosen member states and the EU27 from 1995 to 2010.

39 "Incineration is a method of waste disposal that involves the combustion of waste. It may refer to incineration on land or at sea. Incineration with energy recovery refers to incineration processes where the energy created in the combustion process is harnessed for re-use, for example for power generation. Incineration without energy recovery means the heat generated by combustion is dissipated in the environment". Definition from Eurostat, http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Main_Page (15/11/2013).

40 Article 4(1) of Directive 2008/98/EC.

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to 38 % and in the Netherlands from 25 to 33 %. The amount of incinerated waste in Spain increased from 5 % to 9 % while incineration virtually did not exist as a waste treatment technique in the three new member states and Greece. Thus Estonia and Poland, which decreased landfill rates significantly in the timeframe from 1995 to 2010, did not use incineration as an alternative to landfilling as it seems to be the case for Sweden, Germany and the Netherlands.[41]

c) Recycling Rates[42]

This category of waste treatment (indicator II: overall recycling rate) plays a key role within the EU's initiative regarding resource-efficiency. Especially the vision to establish a circular economy in Europe based on a high level of recycled material was highlighted in the documents analysed in chapter II. Recycling in general is mentioned in priority (c) of the waste hierarchy.[43] The average rate of material recycling in the EU27 shows a positive and stable growth of about 5 % every five years from 1995 to 2010 (overall rate of 10 % in 1995 and of 24 % in 2010). First, consider the group of states for which the presented data above showed a significant change in using the methods of landfilling and incineration (Sweden, Germany and the Netherlands); the data for the usage of material recycling underlines the presumption that these countries restructured their waste treatment systems in general. All of these three member states started with a rate of material recycled waste between 17 % and 20 % in 1995. In 2010, Germany increased its amount to 55 %, Sweden to 36 % and the Netherlands to 28 %. Particularly the change of rate for Germany illustrates that it is possible to reach a significant increase in the amount of material recycled of the generated municipal waste and to take a step towards the outlined vision of a circular economy. A second group of states, namely Greece, Spain, Poland and Estonia, presented recycling rates between 12 % (Estonia) and 17 % (Greece) for the year 2010. These four countries also increased the amount of material recycled within the 15 year timeframe. Nevertheless, their rates remained under the described average for the EU27. Romania is the only country of the eight examples in which almost no material recycling existed. However, apart from the example of Romania, the average rate of the EU27, as well as of the seven highlighted rates for specific member states, shows a permanent increase of the usage of material recycling as a method of waste treatment. Nevertheless, as the material recycling rate for the whole EU27 clearly points out, an on-going and significant change of waste treatment is needed to reach the goals of the EU's resource-efficiency initiative.

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41 See the Annex for incineration rates of the eight chosen member states and the EU27 from 1995 to 2010.

42 For a definion of recycling see under IV.1.b).

43 Article 4(1) of Directive 2008/98/EC.

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d) Composting[44]

A fourth method of waste treatment is to compost specific waste streams. This method also represents a type of recycling and is to be classified as a recycling operation in accordance with priority (c) of the waste hierarchy.[45] For that reason, the amount of composted waste is often added to the rate of material recycled to establish a category of data with "positive" methods of treatment, besides landfilling and incineration, where the waste material is lost during the process of treatment. Within the EU27, the amount of composted waste has risen from 6 % in 1995 to 14 % in 2010. For most of the eight member states the data shows a constant trend of an increasing use of composting while for some member states the composting rates remained stable. The Netherlands, for example, reached the highest rate of composted waste with a stable amount of 23-24 %. On the other hand, in Romania and Greece composting was virtually non-existent. Spain, Poland and Estonia started to compost waste within the analysed 15 year timeframe. In 2010, Poland and Estonia reached a level of 7-8 %, whereas Spain raised their rate from 0 % to 18 % in the same period. Data for Sweden (14 % in 2010) and Germany (17 % in 2010) shows a permanent increase of the composted amounts of municipal waste.[46]

e) Overall Waste Generation and Treatment

When referring to indicator III (total waste generation) to measure the EU's progress in waste management, the data for the overall generation and general treatment of municipal waste in the whole EU27 and the eight member states will be used to derive trends concerning priority (a) – waste prevention.[47] On the level of EU27, overall waste generation per capita within the timeframe of 1995 to 2010 was stable, ranging between 474 kg in 1995 (lowest rate) and 523 kg in 2000 (highest rate). Within the same period, the amount of treated waste increased from 92 % in 1995 to 97 % in 2010. Nevertheless, in addition to the high average rate of treated waste for the EU27 in general, countries which are facing problems to guarantee a region-wide basic treatment of their generated municipal waste still exist. For example, in Estonia the amount of treated waste decreased from 100 % in 1995 to 86 % in 2010. Surprisingly, a similar phenomenon can be observed in the Netherlands with a rate of 97 % in 1995 which declined to 84 % in 2010. Poland and Romania

44 "Composting is defined as a biological process that submits biodegradable waste to anaerobic or aerobic decomposition and that results in a product used on land or for the production of growing media or substrates". Definition from Eurostat, http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Main_Page (15/11/2013).

45 See under IV.1.b).

46 See the Annex for composting rates of the eight chosen member states and the EU27 from 1995 to 2010.

47 Article 4(1) of Directive 2008/98/EC.

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also show rates for treated waste between 80 % and 85 % in 2010. However, while in Romania the rate of treated municipal waste went up, the data shows a similar phenomenon for Estonia and Poland, where the rate dropped from 100 % before joining the EU to 80-85 % from 2005. Rates of treated municipal waste in Sweden, Germany, Spain and Greece are between 95 % and 100 % in 2010, whereas particularly Spain and Germany were able to raise their rates significantly during the last 15 years. In the case of Greece there is a lack of data for the year 1995. All in all, the averaged rate of treated waste for the entire EU27 shows a positive trend (97 % in 2010). However, it should be noted that the three new member states discussed here and the Netherlands did not treat the generated waste adequately. Germany, Spain and the Netherlands consistently produced more kg per capita of municipal waste than the averaging rate for the EU27. Therefore, Germany and Estonia are the only member states which were able to lower the amount of generated waste in 2010 below the rate of 1995. In general, it seems reasonable to explain the rate decline from 2005 to 2010 for overall generated waste in some member states as well as in the EU27 as an effect of the economic crises starting in 2007/08. However, based on this data, there does not exist a recognizable trend of significant decreasing waste generation in general.[48]

3. Interpretation of Data

Interpreting the presented data under the new policy goals mentioned in chapter II to promote waste prevention, re-use and recycling and to eliminate landfilling while limiting other forms of disposal and recovery, it is obvious that a dramatic change of the used methods of waste treatment will be needed to establish sustainable material use. Especially the landfill rates remain high especially when taking into account that the option to landfill waste should be virtually eliminated by the year 2020. Incineration and recycling rates increased permanently on the level of the EU27 in general. Nevertheless, huge differences exist between member states. In the case of eliminating landfilling and promoting recycling, member states such as Germany and Sweden made good progress. Therefore, the practicality of transferring best practices from these countries to the EU-level will be discussed in section V.1. In the case of waste prevention, no progress is recognizable, neither on the EU27-level nor in any of the chosen member states. Therefore, the approach to establish product design criteria to ensure a better recyclability of materials and products as a step towards a more efficient waste prevention will be discussed in section V.2.

48 See the Annex for data on overall waste generation of the eight chosen member states and the EU27 from 1995 to 2010.

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IV. The Reviewed Waste Framework Directive

As already mentioned in the introduction to this article, the 6th EAP called for a revision of the legislation on waste. The main aim of the Programme within this context was to develop measures regarding waste prevention and management, including the setting of targets.[49] Furthermore, the "Thematic Strategy on the prevention and recycling of waste" emphasised the need to assess the existing definitions of recovery and disposal, the need for a generally applicable definition of recycling and a debate on the definition of waste.[50] Within these provisions, the new Waste Framework Directive was adopted by the European Parliament and Council in 2008. That restructured Directive provides a number of new approaches to Europe's waste management.[51] The continuing main goal of reaching a high level of environmental protection by establishing an adequate waste legislation is highlighted by negative effects of the generation and management of waste on human health and the environment. Waste policy should also aim at reducing the use of resources, and favour the practical application of the waste hierarchy".[52] On the other hand, recital 28 introduces a more resource-oriented approach to waste management. It aims to bring the EU "closer to a 'Recycling Society', seeking to avoid waste generation and to use waste as a resource. [...] In line with that objective and as a means to facilitating or improving its recovery potential, waste should be separately collected, if technically, environmentally and economically practicable, before undergoing recovery operations that deliver the best overall environmental outcome".[53] This new approach is also reflected by recital 29 which calls member states to support the use of recyclates "in line with the waste hierarchy and with the aim of a recycling society, and should not support the landfilling or incineration of such recyclates whenever possible".[54]

1. The Five Step Waste Hierarchy

The instrument of a waste hierarchy has existed for more than 20 years in the European waste law. For the first time, it was introduced in the Waste Framework Directive in 1991.[55] The European Commission declares the new waste hierarchy as the "cornerstone" of European waste policies and legislation, which is addressed to

49 See Decision 1600/2002/EC laying down the Sixth Community Environment Action Programme, OJ L 242 of 10/9/2002, p. 1

50 COM (2005) 666 final, p. 6 et seqq.

51 *Meßerschmidt*, Europäisches Umweltrecht, 2011, p. 846.

52 Recital 6 of Directive 2008/98/EC.

53 Recital 28 of Directive 2008/98/EC.

54 Recital 29 of Directive 2008/98/EC.

55 See Article 2(1) of Directive 91/156/EEC.

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the member states. They have to respect the hierarchy in their waste management policy and legislation. In addition, coherence of the European waste legislation to the hierarchy should be guaranteed as well. Its primary purpose is to minimize adverse environmental effects from waste and to promote resource-efficiency in Europe's waste management and policy.[56] The waste hierarchy generally cements a priority order of what constitutes the best overall environmental option in waste policy and legislation. The priority order of the hierarchy is laid down in Article 4 WFD. The hierarchy provides five possible ways of dealing with waste (understanding that prevention concerns substances or objects before they become waste). The five steps of the hierarchy are the following:

(a) Prevention;

(b) Preparing for re-use;

(c) Recycling;

(d) Other recovery, e.g. energy recovery;

(e) Disposal.[57]

In contrast to the "old" waste hierarchy of the Waste Framework Directive from 2006,[58] the priority order has been extended significantly. The former waste hierarchy was only designed with three steps: prevention, "recovery" and disposal. Furthermore, previous waste legislation gave equal importance to "preparation for re-use", recycling and other recovery, all covered by priority two (the term recovery). To establish a more resource-saving oriented waste management, the new hierarchy gives clear priority to "preparation for re-use" over recycling and to recycling over all other types of recovery.[59] As already mentioned, the waste hierarchy shall apply as a priority to waste policy and legislation. A consequence from that design is that the hierarchy is not legally binding in any case. Article 4(2) WFD gives member states a degree of flexibility by integrating the hierarchy to their waste management regulations.[60] This flexibility arises from the overall goal of the Waste Framework Directive to reach the highest possible level of environmental protection. This means that achieving this aim may entail a deviation from the priority order of the hierarchy for specific waste streams. Furthermore, there has to be a justification based on life-cycle-thinking (LCT). In that regard, Article 4 WFD formulates that "Member States shall take into account the general environmental protection

56 Guidance on the interpretation of key provisions of Directive 2008/98/EC on waste, 2012, p. 3.

57 See Article 4 of Directive 2008/98/EC.

58 See Article 3 of Directive 2006/12/EC.

59 *Meßerschmidt*, (fn. 51), p. 909 et seq.

60 *Petersen*, Entwicklungen des Kreislaufwirtschaftsrechts – Die neue Abfallrahmenrichtlinie – Auswirkungen auf das Kreislaufwirtschafts- und Abfallgesetz, NVwZ 2009, p. 1063 et seqq.

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principles of precaution and sustainability, technical feasibility and economic viability, protection of resources as well as the overall environmental, human health, economic and social impacts".[61] When applying the waste hierarchy, member states are also required to ensure that the development of waste policy and legislation is a fully transparent process.[62] As it is not the goal to analyse national waste legislation, the possibility to deviate from the waste hierarchy based on Article 4(2) is not focused on in detail. To clarify the differences between the five priorities of the new hierarchy, each step will be focused on in detail in the following sections.

a) Prevention and Re-use

The legal definition of prevention laid down in Article 3 WFD describes prevention as measures taken before a substance, material or product has become waste that reduce the quantity of waste (e.g. through re-use of products), the adverse impacts of waste on the environment and human health, or the content of harmful substances in materials and products.[63] Hence, this definition includes a quantitative (reducing generated waste) and a qualitative (reducing environmental impact or the use of harmful substances) dimension.[64]

Therefore, one way to promote waste prevention is to increase the re-use of materials and products. Legally, re-use is defined as "any operation by which products or components that are not waste are used again for the same purpose for which they were conceived".[65] It is obvious that the concept of re-use has a direct effect on promoting resource-efficiency by extending the durability of products.[66]

Annex IV of the Waste Framework Directive provides a non-exhaustive list with examples of actions to increase waste prevention, such as economic incentives, taxes, deposits, online information portals, voluntary consumer/producer agreements or information campaigns.[67] But as the empirical analysis of waste generation has shown,[68] existing approaches for waste prevention were not followed in the path or did not lead to a decrease of waste generation. In contrast, waste generation increased in the majority of member states and the EU27 between 1995 and 2010. In that regard, Article 9 WFD is a new legal basis for a possible legislative process

61 Article 4(2) of Directive 2008/98/EC.

62 Article 4(2), number 3, of Directive 2008/98/EC.

63 Article 3(12) of Directive 2008/98/EC.

64 *Faßbender*, Abfallhierarchie, Vermeidungsprogramme, Recyclingquoten – Wirksame Instrumente für Vermeidung und Ressourcenschutz?, AbfallR 2011, p. 165 et seqq.

65 Article 3(13) of Directive 2008/98/EC.

66 *Prelle*, Begriff und Bedeutung der (Vorbereitung zur) Wiederverwendung im Abfallrecht, AbfallR 2008, p. 220 et seqq.

67 Annex IV of Directive 2008/98/EC.

68 See chapter III.

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initiated by the Commission. As a first step, by using this new legal basis, the European Commission should evaluate the potential for waste prevention including the formulation of a product design legislation addressing both the generation of waste and the presence of hazardous substances in waste (with a focus on durable, re-usable and recyclable products).[69] Furthermore, the Commission should develop an action plan for further supporting measures to change current consumption patterns.[70] In a second step, the Commission could propose the setting of waste prevention and decoupling objectives for the year 2020, including a revision of the indicators referred to in Article 29(4).[71] Similarly, Article 29 constitutes a new obligation of waste prevention. This new instrument was introduced to promote waste prevention on the level of member states. Thus, Article 29 lays down that every member state has to establish a national waste prevention programme by December 2013. Such programmes shall be integrated either into existing waste management plans,[72] into other environmental policy programmes or shall function as separate programmes.[73] Furthermore, these programmes shall describe the waste prevention objectives and the existing prevention measures and evaluate the usefulness of elected prevention options.[74] In addition, member states shall develop qualitative or quantitative benchmarks and/or targets to measure the progress in the field of waste prevention,[75] while the Commission should support the exchange of best practices.[76] Taking into consideration that the waste prevention plans will be under development until the end of 2013, it is only possible to speculate at this early point if the programmes will be able to have a significant impact on the aim to promote waste prevention. However, reflecting the new legal basis in Articles 9 and 29 WFD, the Commission as well as the member states have a new possibility to establish useful waste prevention programmes.

b) Preparation for Re-use and Recycling

Besides the approach to prevent waste generation, the waste hierarchy establishes four priorities for waste treatment, with treatment in general being defined as "recovery or disposal operations, including preparation prior to recovery or disposal".[77] As shown above, the new waste hierarchy introduces three priorities into the wider

69 Article 9(a) of Directive 2008/98/EC.

70 Article 9(b) of Directive 2008/98/EC.

71 Article 9(c) of Directive 2008/98/EC.

72 See Article 28 of Directive 2008/98/EC.

73 Article 29(1) of Directive 2008/98/EC.

74 Article 29(2) of Directive 2008/98/EC.

75 Article 29(3) and (4) of Directive 2008/98/EC.

76 Article 29(5) of Directive 2008/98/EC.

77 Article 3(14) of Directive 2008/98/EC.

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frame of the term recovery. Recovery in general, as it is legally defined in the new Waste Framework Directive, means "any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfill a particular function, or waste being prepared to fulfill that function, in the plant or in the wider economy".[78] This restructured understanding of recovery can be seen as a reaction to and a further development of the ECJ's jurisdiction of the last decade. It affects mainly the distinction between priority (d) other recovery and priority (e) disposal which will be discussed after focusing on the two superior priorities preparing for re-use and recycling.

Preparing for re-use, as the most preferable recovery option in the new waste hierarchy, is defined within the Waste Framework Directive for the first time as "checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be re-used without any other pre-processing".[79] The key difference between re-use and preparing for re-use is that in the former case the material or object has not become a waste.[80] If a product or material reaches the end-of-waste status after being prepared for re-use but before being de facto in re-use all depends on the fulfilling of the criteria named in Article 6 WFD.[81] Examples for the preparation for re-use are the repairing of bicycles or furniture.[82] Thus, the exact differentiation between the preparing for re-use and a recovery process as recycling could be difficult in practice. As recycling is defined as "any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes"[83] a repair of a product can be both preparing for re-use and/or recycling depending on the concrete process of repairing. Concerning this problem, it is argued in general that a dismantling or processing of waste relates to the category of recycling and that the repairing of only components of this waste, without generating a substantial restructuring of the waste material, could be preparing for re-use.[84] The future role of the new and highly prioritised preparing for re-use in Europe's waste management remains unclear due to a lack of empirical data. But as chapter III shows, material recycling is an important method of waste treatment in a high number of member states. The new Waste Framework Directive defines recycling for the first time as a recovery process by which waste materials are reprocessed into products, materials or substances. Recycling also "includes the reprocessing of

78 Article 3(15) and Annex II of Directive 2008/98/EC.

79 Article 3(16) of Directive 2008/98/EC.

80 *Prelle*, (fn. 66), pp. 221-223.

81 See Article 6 of Directive 2008/98/EC and under section IV.3.

82 Guidance on the interpretation of key provisions of Directive 2008/98/EC on waste, 2012, p. 30.

83 Article 3(17) of Directive 2008/98/EC.

84 *Prelle*, (fn. 66), p. 222 et seqq.

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organic material, but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations".[85] The idea behind the third priority of the waste hierarchy is that a waste material is processed in order to alter its physical/chemical properties, thereby allowing it to be used again for the same or other applications.[86] As it is a goal of the resource-efficiency initiative as well as a provision in recital 28 and Article 11(2) of the new Waste Framework Directive, the EU should move towards a "European Recycling Society". In that regard, the promotion of recycling as a method of waste treatment plays an important role. Specific types of recycling are, for example, the recycling of materials or the production of compost.[87]

In connection with the goal of promoting re-use and recycling, the Waste Framework Directive establishes concrete targets for plastic, metal, paper and glass to reach by the year 2020. For at least these four waste materials member states shall guarantee a minimum recovery rate (using preparation for re-use and/or recycling) of overall 50 % of weight from households, and possibly from other origins insofar as these waste streams are similar to waste from households (as the focused stream of municipal waste in chapter III).[88] The term "overall 50 %" implies the possibility for member states to prorate preparing for re-use and/or recycling rates (for example 60 % for plastic and 40 % for metal) to an average rate of 50 % to fulfill their obligations.[89] By the end of 2014, the European Commission has the possibility to reinforce the targets and to consider the setting of targets for other waste streams through proposing a new legislative act.[90] The introduction of these new rules can be seen as the first moderate steps to promote re-use and recycling using concrete targets for specific materials for which recovery processes are technically and economically feasible, while also securing environmental protection at the same time. Because of the formulation in Article 11 – "[if] targets are not met, this report [member states have to report every three years to the European Commission concerning their progress on reaching the targets] shall include the reasons for failure and the actions the Member State intends to take to meet those targets"[91] – it can be argued that the Commission will not be able to use infringement proceedings against member states which fail to reach the targets of Article 11(2).[92]

85 Article 3(17) of Directive 2008/98/EC.

86 Guidance on the interpretation of key provisions of Directive 2008/98/EC on waste, 2012, p. 32.

87 Ibid.

88 Article 11(2a) of Directive 2008/98/EC.

89 *Hurst*, Die Umsetzung der Abfallrahmenrichtlinie aus Sicht der privaten Entsorgungswirtschaft, AbfallR 2009, p. 159 et seqq.

90 Article 11(4) of Directive 2008/98/EC.

91 Article 11(5) of Directive 2008/98/EC.

92 *Petersen*, (fn. 60), p. 1072.

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c) Other Recovery and Disposal

The priority of other recovery has no legal definition in the new Waste Framework Directive. For that reason, it can be interpreted as any operation meeting the definition for recovery but failing to comply with the requirements for the discussed preparation for re-use or for recycling.[93] Other recovery operations are, for example, waste incineration or backfilling operations (which meet the recovery definition and are in compliance with the Articles 4 and 13 WFD).[94] Waste disposal, by contrast, "means any operation which is not recovery even where the operation has as a secondary consequence of the reclamation of substances or energy".[95] Thus, waste disposal is to be differentiated from other recovery by the negative criterion as disposal operations are methods of treatment which do not meet the recovery definition. Examples for waste disposal are landfilling and also incineration processes.

The distinction between if an incineration process should be categorized as an energy recovery or a disposal operation has been discussed controversially in the last years because the former Waste Framework Directive provided no clear differentiation between these terms.[96] In its Luxembourg decision, for example, the ECJ defined the incineration of waste as a disposal operation.[97] Thus, the new definition of recovery takes as its starting point the created ECJ case law, where the approach of substitution as a precondition for recovery was developed mainly in two rulings of the ECJ.[98] Following this approach, a first important aspect to distinguish recovery from disposal is that waste has to serve a useful purpose "as a principal result" to meet the definition of a recovery operation. The ECJ has stated with respect to the incineration of waste in cement kilns that

> "it follows from the term principally used [...] that the waste must be used principally as a fuel or other means of generating energy, which means that the greater part of the waste must be consumed during the operation and the greater part of the energy generated must be recovered and used".[99]

This new approach is also highlighted in the definition for disposal. In this case the term "even where the operation has as a secondary consequence the reclamation of substances or energy" of the disposal definition describes the idea that any recovery

93 Guidance on the interpretation of key provisions of Directive 2008/98/EC on waste, 2012, p. 33.

94 Ibid.

95 Article 3(19) of Directive 2008/98/EC.

96 *Petersen*, (fn. 60), p. 1067 et seq.

97 See *Stengler*, Europäische Leitlinien zur Energieeffizienzberechnung in Abfallverbrennungsanlagen, AbfallR 2011, p. 213 et seqq.; ECJ, case C-458/00, *Grand Duchy of Luxemburg*, ECR 2003, I-1553.

98 See ECJ, case C-6/00, *ASA*, ECR 2002, I-1961; ECJ, case C-228/00, *Cement kilns*, ECR 2003, I-1439.

99 See ibid.; Guidance on the interpretation of key provisions of Directive 2008/98/EC on waste, 2012, p. 30.

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must fulfill the criterion of "the principal result"; that being waste serving a useful purpose by substituting material which would otherwise have been used for that purpose.[100] A second important new aspect of the recovery definition in the Waste Framework Directive is that the substitution achieved can take place not just in the plant where the waste is being treated but also "in the wider economy".[101] Besides these process-oriented new definitions, an output-oriented rule was established in the new Waste Framework Directive. Thus, a classification of the incineration of municipal solid waste as recovery or disposal depends on the energy-efficiency coefficient of the incineration facility. To measure the energy-efficiency of an incinerator, the R1 Formula in Annex II of the Waste Framework Directive was introduced. That Formula lays down that an incineration facility has to reach a level of energy-efficiency of 0.60 (for facilities which are in operation and which were permitted under European law before 2009) and of 0.65 (for facilities which were permitted after 2008) to get the recovery status. In simplified terms, this energy-efficiency coefficient describes the proportion of the overall energy produced by an incinerator (EP = Energy Produced) and the amount of energy generated by the incineration of waste (EW = Energy Waste). Energy externally applied to the incineration process (e.g. EF = Energy Fuels, for example oil or gas, or EI = Energy Introduced, for example electrical power) is to be subtracted by calculating the energy-efficiency coefficient.[102] If an incinerator is not able to reach the energy-efficiency coefficient, the process of waste treatment in this facility has to be classified as waste disposal.

2. Waste Hierarchy and Policy Instruments

The analysis of the new waste hierarchy has shown that it is the aim of the new Waste Framework Directive to promote a shift towards a more climate protection and resource-oriented understanding of waste management with a focus on waste prevention, re-use and recycling. With its five priorities, the hierarchy provides a clear and differentiated order. Nevertheless, the hierarchy is a flexible instrument and not unexceptionally legally binding.[103] Thus, member states are encouraged to ensure coherence between their national waste policy and legislation and the priorities of the hierarchy. The possible future role of these national waste prevention programmes is to promote resource-efficiency in waste management. Also the effect of the new recovery category preparing for re-use and the potential of re-use activities in general will have to be evaluated in future years. The introduction of recycling

100 Ibid., p. 34.

101 Ibid., p. 30.

102 *Stengler*, (fn. 97), p. 214; Guidelines on the interpretation of the R1 Energy Efficiency Formula for incineration facilities dedicated to the processing of municipal solid waste according to Annex II of Directive 2008/98/EC on waste, 2011.

103 *Petersen*, (fn. 60), p. 1067.

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targets for at least four waste materials is a positive approach to strengthen the general role of recycling as the third priority in the hierarchy. The new definitions for other recovery and disposal will facilitate the differentiation between these two treatment methods in the future. Furthermore, besides the basically efficient approaches of prevention, re-use and recycling, the introduction of an energy-efficiency criterion seems to be a first step towards more resource-efficiency. Even so, the data in chapter III made clear that today's waste management in the EU needs to change significantly to ensure coherence with the new hierarchy in practice.

a) Separate Waste Collection

One objective of the new Waste Framework Directive is to call the member states to establish a comprehensive network of waste collection to facilitate high-quality recovery operations of waste.[104] In this regard, the Waste Framework Directive especially favors separate collection which "means the collection where a waste stream is kept separately by type and nature so as to facilitate a specific treatment",[105] and ensures the best treatment method possible of the different waste streams. Thus, Article 10(2) WFD lays down that for the purpose of facilitating or improving recovery, "waste shall be collected separately if technically, environmentally and economically practicable and shall not be mixed with other waste or other material with different properties".[106] In connection with this provision, member states shall set up separate collections for at least paper, metal, plastic and glass by the year 2015.[107] This ruling has to be interpreted in line with the provision concerning the recovery of these four waste materials because if such waste materials are collected with mixed household waste, a recovery process for materials will be economically inefficient and for some materials technically impossible.[108] In addition, Article 22 encourages member states to take measures to separate collection of bio-waste.[109] All in all, separate collection is defined as a key pre-condition to ensure high-quality treatment with the best available methods of treatment in line with the priorities of the waste hierarchy.

b) The Principles of Self-Sufficiency and Proximity

A second new provision connected with the collection of waste of the Waste Framework Directive is a modification of Article 16, which cements the principles

104 See e.g. recitals 15, 16, 17, 28, 32, 34 and 35 of Directive 2008/98/EC.

105 Article 3(11) of Directive 2008/98/EC.

106 Article 10(2) of Directive 2008/98/EC.

107 Article 11(2) of Directive 2008/98/EC.

108 *Hurst*, (fn. 89), p. 164; Article 11(2a) of Directive 2008/98/EC.

109 Article 22(a) of Directive 2008/98/EC.

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of self-sufficiency and proximity.[110] Concerning the principle of self-sufficiency, member states shall "establish an integrated and adequate network of waste disposal installations and of installations for the recovery of mixed municipal waste collected from private households, including where such collection also covers such waste from other producers, taking into account best available techniques".[111] The new part in this provision consists of the fact that the principle of self-sufficiency applies not only to waste to dispose but also to mixed municipal waste for recovery.[112] In the case of the principle of proximity, it is defined that the integrated network of installations shall ensure that waste for disposal or mixed municipal waste for recovery can be treated in one of the nearest appropriate installations "by means of the most appropriate methods and technologies, in order to ensure a high level of protection for the environment and public health".[113] The modification of both principles can be seen as a logical consequence of two modified Articles of the also reviewed Regulation (EC) No 1013/2006 on the shipments of waste.[114] The first provision in that regard is that mixed municipal waste for recovery has to fulfill the same legal conditions as waste for disposal. That means that mixed municipal waste from private households has to fulfill the criteria of the notification process for waste shipments as waste to dispose.[115] The second new aspect is that a public authority can prohibit the shipment of mixed municipal waste from private households in general.[116] These two rulings show that mixed municipal waste for recovery from private households is not a good which no longer fulfills the conditions of the free movements of goods in the internal market of the EU anymore. Public authorities can now prohibit shipments of that waste stream. A difference between the new Waste Framework Directive and the Waste Shipment Regulation is that the regulation refers clearly to the waste type 200301 (mixed municipal waste) of the European waste list,[117] while the Waste Framework Directive only uses the same wording of the waste type without naming a specific waste list number. Nevertheless, in practice it will not make any difference and it can be assumed that the Waste Framework Directive also refers to waste type 200301.[118] In spite of the modification of the principles of self-sufficiency and proximity, public authorities should not use these new competencies to protect their national waste management facilities, for example, to ensure high rates of plant utilization of incinerators for waste disposal

110 See Article 16 of Directive 208/98/EC.

111 Article 16(1) of Directive 2008/98/EC.

112 Article 16(2) of Directive 2008/98/EC.

113 Article 16(3) of Directive 2008/98/EC.

114 See Regulation 1013/2006/EC.

115 Article 3(5) of Regulation 1013/2006/EC.

116 Article 11(1i) of Regulation 1013/2006/EC.

117 See Decision 2000/532/EC establishing a list of wastes, OJ L 226 of 6/9/2000, p. 3.

118 *Hurst*, (fn. 89), p. 162 et seq.

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in Germany.[119] Instead, the criteria of the best available treatment method in line with the waste hierarchy and environmental protection should be used to ensure high-quality treatment of mixed municipal waste from private households.

c) Extended Producer Responsibility

For the first time, the instrument of an extended producer responsibility was introduced in the new Waste Framework Directive. Nevertheless, the principle of an extended producer responsibility is not new in national and European legislation. On the EU-level, for example, specific directives on packaging waste, on end-of-life vehicles, on waste batteries and accumulators, combined with the new WEEE-Directive on waste on electrical and electronic equipment are based on this principle.[120] The aim of Article 8 of the new Waste Framework Directive is to give member states the possibility to strengthen the hierarchy priorities of waste prevention and re-use, recycling and other recovery discussed above. For that purpose, member states "may take legislative or non-legislative measures to ensure that any natural or legal person who professionally develops, manufactures, processes, treats, sells or imports products (producer of the product) has extended producer responsibility".[121] Establishing such instruments, member states are allowed to oblige producers to accept returned products or the waste of these products in order to guarantee a subsequent management of the waste and financial responsibility for such activities.[122] Furthermore, by applying an extended producer responsibility, member states can establish measures to encourage the design of products in order to reduce their environmental impact and the generation of waste.[123] Especially in this case, but also regarding to other approaches for an extended producer responsibility on a national level, it is of great importance that such measures do not have negative effects on the functioning of the common internal market.[124] A second important provision for national legislatures is that "extended producer responsibility shall be applied [...] without prejudice to existing waste stream specific and product-specific legislation".[125] Taking these two provisions into account, the

119 *Cosson*, Die Neuordnung der Entsorgungszuständigkeiten – Überlassungspflicht aus Sicht der privaten Entsorger, AbfallR 2009, p. 154 et seqq.

120 *Prelle*, (fn. 66), p. 223 et seqq.; Directive 1994/62/EC on packaging and packaging waste, OJ L 365 of 31/12/1994, p. 10; Directive 2000/53/EC on end-of life vehicle, OJ L 269 of 21/10/2000, p. 34; Directive 2006/66/EC on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC, OJ L 266 of 26/9/2006, p. 1; Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), OJ L 197 of 24/7/2012, p. 38.

121 Article 8(1) of Diretive 2008/98/EC.

122 Ibid.; *Hurst*, (fn. 89), p. 166 et seq.

123 Article 8(2) of Directive 2008/98/EC.

124 Article 8(3) of Directive 2008/98/EC.

125 Article 8(4) of Directive 2008/98/EC.

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possibilities to use the instrument of extended producer responsibility are limited. However, with that instrument member states are able to establish innovative solutions to promote, for example, waste prevention within their waste prevention programmes. Whereas Article 8 WFD addresses the member states, the examples of existing directives mentioned above have shown that the principle of an extended producer responsibility can play an important role for legislative acts on the European level in the future.[126]

V. Integrating Resource-Efficiency into Law

As the empirical data in chapter III has shown, the EU as a whole is far from reaching the goal of a "European Circular Economy". Therefore, two possibilities to further develop the European law will be discussed exemplarily in this chapter.

The first option is related to the provision of the "Roadmap to a Resource Efficient Europe" and the 7th Environmental Actions Programme to stop landfilling in the EU by the year 2020 and to review for that purpose existing landfill targets to ensure coherence with that goal.[127] The empirical data has shown that some member states were able to stop landfilling. Nevertheless, this method of waste treatment is still used by a high number of member states. On this basis, the existing Directive on the landfill of waste will be analysed in section V.1.

The second approach concerns the promotion of re-usability and recyclability of products and of the market of secondary raw materials by establishing product design standards. Furthermore an approach described in the "Roadmap to a Resource Efficient Europe" aims to assess the introduction of minimum recycled material rates, durability and re-usability criteria.[128] This option will be discussed in the frame of the Ecodesign Directive in section V.2.

1. European Landfill Legislation

As the empirical analysis has shown, landfilling is still a widely used method of waste treatment in the European Union. But while, for example, Germany, Sweden and the Netherlands have virtually eliminated their landfilling activities during the last 17 years, countries as Romania, Greece, Poland, Estonia and Spain landfilled more than half of their overall generated municipal waste in 2010.[129] Since 1999, a specific

126 *Petersen*, (fn. 60), p. 1071.

127 COM (2011) 571 final, p. 8.

128 Ibid.

129 See chapter III and the Annex.

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legislative framework regarding landfilling exists on the European level. The Landfill Directive was established to reduce the adverse effects of landfilling of waste on the environment, in particular on surface water, groundwater, soil, air and human health. It also adds to the greenhouse effect because of the huge methane gas emissions from landfills.[130] For that purpose, technical requirements for landfill sites (e.g. control and monitoring procedures in the operational phase[131] and closure and after-care procedures of a landfill[132]), rules for waste acceptance on the sites[133] and three landfill categories depending on the waste intended to be disposed of were defined. These categories are landfills for hazardous waste, landfills for non-hazardous waste and landfills for inert waste.[134] Within this categorisation, landfills for non-hazardous waste may be used by the member states, *inter alia*, to dispose municipal waste which is the focus of this paper.[135] In addition, member states are obliged to ensure that competent national authorities issue permits to operate the sites.[136] This provision illustrates the specific responsibility of member states for waste to dispose which is affected by the principles of self-sufficiency and proximity.[137] Taking into consideration that the Landfill Directive entered into force in 1999, this section examines the possibility to review the existing Directive to ensure coherence with the resource-oriented approach of waste treatment of the resource-efficiency initiative, the 7th EAP and the waste hierarchy of the Waste Framework Directive.

a) Key Provisions

A landfill in the sense of the Directive is a permanent waste disposal site (more than one year) for the deposit of waste onto or into land which is used for temporary storage of waste. Excluded from this definition are facilities where waste is unloaded in order to permit its preparation for further transport for recovery, treatment or disposal elsewhere.[138] Member states have to ensure that only waste that has been subject to a treatment (physical, thermal, chemical or biological processes that change the characteristics of the waste in order to reduce its volume or hazardous nature, facilitate its handling or enhance recovery) is landfilled.[139]

130 See recital 6 and Article 1(1) of Directive 1999/31/EC.

131 Article 12 of Directive 1999/31/EC.

132 Article 13 of Directive 1999/31/EC.

133 See Articles 6 and 11 of Directive 1999/31/EC.

134 Article 4 with Article 2 of Directive 1999/31/EC; Decision 2003/33/EC establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC, OJ L 11 of 16/1/2003, p. 27.

135 Article 6(c) of Directive 199/31/EC.

136 See Articles 7, 8 and 9 of Directive 1999/31/EC.

137 See under III.2.

138 Article 2(g) of Directive 1999/31/EC.

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One of the core elements of the Directive defines targets for a gradual diversion of biodegradable municipal waste from landfills in order to reduce methane emissions, coupled with technical requirements for capture and treatment of landfill gas.[140] This waste type is defined as "any waste that is capable of undergoing anaerobic or aerobic decomposition, such as food and garden waste, and paper and paperboard".[141] Concerning biodegradable municipal waste, member states were obliged to establish national strategies which ensure that by the year 2006, the amount of biodegradable municipal waste going to landfills had to be reduced to 75 %, by 2009 to 50 % and by 2016 to 35 % of the total amount (by weight) produced in 1995.[142] An exception exists for member states which in 1995 or the latest year before 1995 for which standardised Eurostat data is available, put more than 80 % of their collected municipal waste to landfill. These member states may postpone the attainment of the targets by a period not exceeding four years.[143] In addition, the Directive defines specific materials for which landfilling is prohibited in general. These are, *inter alia*, liquid waste, waste which, in the conditions of landfill, is explosive, corrosive, oxidising or flammable, hospital and other clinical wastes, whole used tyres and any other type of waste which does not fulfill the acceptance criteria laid down in the Directive.[144]

As already mentioned, this Directive was established to reduce the risks arising from landfills on the environment and human health. The specific reduction targets concern only biodegradable waste. From the member states analysed in this study, Poland, Greece, Romania and Estonia had the possibility to derogate from the established targets because of their landfill rates in 1995.[145] These four member states took advantage of the option to fulfill the obligations concerning the landfilling of biodegradable waste four years later.[146]

b) Transposition and National Legislation

In line with the Landfill Directive, the member states of the European Union are obliged to report on the implementation of the Directive.[147] The last available data results from the reports of 2009. In a communication, the Commission pointed out

139 Article 6(a) with Article 2(h) of Directive 1999/31/EC.

140 Report on Implementation of the Community Waste Legislation, COM (2009) 633 final.

141 Article 2(m) of Directive 1999/31/EC.

142 Article 5(2) with Article 18(1) of Directive 1999/31/EC.

143 Ibid.

144 Article 5(3) with Annex II of Directive 1999/31/EC.

145 See the rates for untreated and landfilled waste in 1995 in the Annex.

146 FEAD Press Release, 2011, Workshop on the Implementation of the Landfill Directive, http://www.fead.be/en/press/press-releases/ (15/11/2013).

147 Article 15 of Directive 1999/31/EC.

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that the practical implementation of the Landfill Directive remained highly unsatisfactory more than ten years after its adoption. The national reports made clear that still not all member states had transposed and implemented all its provisions. Moreover, the Commission stated that on a daily basis it received a vast number of complaints related to illegal landfills that lacked the permits required by the EU's waste legislation and caused serious adverse effects to the environment and risks to human health. Only nine member states reached the reduction targets for biodegradable municipal waste in 2006; most problems were reported from the new member states.[148] In 2013, more detailed information concerning the transposition of the Landfill Directive was published in a report by the European Environmental Agency. Within this report it is stated that in the EU, a huge number of illegal landfills still exists. In addition, the majority of the member states of the Union failed to reach the reduction targets for biodegradable municipal waste.[149]

These facts underline that a persistent high risk for the environment and human health resulting from landfills still exists in the EU. Therefore, the goal of the resource-efficiency initiative to eliminate landfilling as a method of waste treatment in general consists of an environmental and a resource-oriented dimension. The resource-oriented dimension arises from the linear correlation between the total landfill charge in a member state and the percentage of municipal waste recycled and composted in the member state. The member states that charge more for landfilling show higher recycling and composted rates and lower landfill rates.[150] As already mentioned, some member states of the EU were able to end their landfill activities. This was possible by using specific legal and/or economic instruments. Germany, the Netherlands and Sweden, for example, established instruments which led to a general ban of landfilling untreated municipal waste while Poland, Spain (on a regional level) and Estonia introduced landfill taxes on municipal waste. In Romania, neither a general ban nor a tax exists. For Greece no data is available.[151] In 2012, in 19 member states different types of landfill restrictions, taxes and/or fees were in place.[152] But while taxes are levied by public authorities for the disposal of waste in a landfill site (e.g. to protect the environment), "gate fees" are set by the operators of the landfills for the provision of the service (the disposal activity).[153] However, the tax rates and fees, materials exempted from the tax or fee and the specific

148 COM (2009) 633 final.

149 European Environmental Agency, Managing municipal solid waste – a review of achievements in 32 European countries, Report 02/2013, p. 21 et seqq.

150 *Watkins et al.*, Use of Economic Instruments and Waste Management Performances, Final report prepared for the European Commission, 2012, p. 4.

151 Screening of waste management performance of EU Member States, Report submitted under the EC project "Support to Member States in improving waste management based on assessment of Member States performance", 2012, p. 16 et seqq.

152 *Watkins et al.*, (fn. 150), p. 52.

153 Ibid., p. 42.

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purposes for which taxes or fees are used vary from country to country.[154] One result from that heterogeneous situation is that the price for landfilling one tonne of municipal waste differs significantly from about 17 Euro up to about 220 Euro in the European Union.[155]

c) The Way to Eliminate Landfilling in Europe

In the light of the goal of the EU to eliminate landfilling in Europe and taking into account that a landfill ban and/or tax can reduce the amount of landfilled waste in the member states, it has to be discussed how a harmonized legislation on the European level could be designed. This instrument should aim at decreasing the amount of landfilled municipal waste and ensure at the same time a high level of protection for the environment and human health. The current Landfill Directive in this regard implies two major problems:

a) The landfill reduction targets set in the Landfill Directive do only address biodegradable municipal waste. This provision is not in line with the political goal to reduce the landfill of all municipal waste, including, for example, plastics and textiles.

b) The term "treatment" is not precisely defined. Therefore, a simple physical treatment to reduce the volume of the waste would be in line with the obligation to treat a waste before landfilling it. This regulation does not ensure environmental and climate protection and is not coherent to the approach of resource saving.

One option to incentivize member states to reduce landfilling effectively could be to set a minimum level of landfill tax which would have to be applied in all member states of the Union.[156] Nevertheless, this option seems inadequate due to differences in the economic conditions in the member states, and it would in any case be difficult to bring about due to the unanimity required by member states on common taxation legislation. Instead of establishing a binding tax, a common method for calculating a flexible minimum tax level could be developed. Such an instrument could be adapted to the varying conditions in the member states.[157] But a flexible instrument to calculate taxes on the national level does not necessarily lead to a consequent use of landfill taxation. With such an instrument, member states would have the possibility to let landfilling be the cheapest method of waste treatment. A third option would be to develop an instrument for a strict obligation of pretreatment all municipal waste before landfilling in the whole European Union.

154 Ibid., p. 167.

155 See for an overview of landfill regulations in all Member State ibid., p. 42 et seqq.

156 Ibid., p. 167 et seqq.

157 Ibid., p. 169.

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Austria and Germany for example, which introduced a strict pre-treatment obligation, have reduced their landfill rate significantly within the last seven years. The landfill ban for untreated waste as it was implemented in Germany requires a pre-treatment (incineration or mechanical-biological treatment), before landfilling substances. The effect of this provision is that prices for landfilling rose significantly and incineration rates, composting and recycling rates went up.[158] On the one hand, severe problems became visible concerning the adequate treatment of municipal waste after the introduction of the ban in 2005[159] and, on the other hand, high incineration capacities were built to dispose the municipal waste which may today potentially hamper a greater use of material recycling. Learning from these experiences in Germany, the introduction of a strict pre-treatment obligation within the EU27, for example in the framework of the already existing European decision concerning waste acceptance criteria on landfills in combination with a rephrased definition of "treatment",[160] would have positive effects on environmental protection and lead to more resource-efficiency. This ban could, for one, be established with an adequate transition period for materials which the Waste Framework Directive sets recycling and collection targets for paper, metal, plastic and glass[161] and be extended to other materials later. At the same time, member states would have the opportunity to establish landfill taxes on their own, which could help to reach the defined goals of an instrument to eliminate landfilling. Taking into account that solely the introduction of a ban would not be a solution for missing waste treatment infrastructure besides the use of landfills in some member states, it would be necessary to develop economic incentives for investing in, for example, recycling facilities and sorting plants. Furthermore, a structure should be developed where representatives from public authorities of the member states could exchange best practices.[162] This idea of a European landfill ban should be discussed in the framework of a review of the Landfill Directive to ensure coherence with the new Waste Framework Directive and the resource-efficiency initiative.

2. Improving Product Design

In contrast to the approach to strengthen EU's legislation concerning materials which reached their end of life as discussed in section V.1, this section aims to analyse options for a legal basis to introduce measures to design products and materials with a view to facilitate their recovery and to minimize the amount of waste at the end of their life. The promotion of this approach is mentioned in the "Roadmap to a

158 See the Annex; *Watkins et al.*, (fn. 150), p. 70.

159 *Rade*, 1. Juni 2006 – Ein Jahr Umsetzung der Abfallablagerungsverordnung/TA Siedlungsabfall, Eine Bestandsaufnahme aus Bundessicht, Müll und Abfall 2006, p. 284 et seqq.

160 See Decision 2003/33/EC.

161 See under IV.1.

162 For example a landfill forum in the framework of the European Environmental Agency.

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Resource Efficient Europe" as well as in the 7th EAP. Both initiatives call for setting requirements to boost a material's resource-efficiency by developing a framework to increase re-usability and recyclability of products and to assess the possibility of setting targets regarding using secondary raw materials in the production process of new products.[163] A pre-existing instrument which addresses the design of products in the EU is the Ecodesign Directive. This Directive defines ecodesign as "the integration of environmental aspects into product design with the aim of improving the environmental performance of the product throughout its whole life cycle".[164] The goal of this Directive is to establish a framework for the setting of ecodesign requirements for energy-related products. To establish criteria for more material resource-efficiency for specific products, the Roadmap proposes an expansion of the scope of the Ecodesign Directive to non-energy related products.[165]

a) The Ecodesign Directive

Unlike to the Waste Framework Directive and the Landfill Directive, the Ecodesign Directive is based on the competence of the European Union to establish a functioning internal market. It is argued that disparities between national laws in relation to the ecodesign of energy-related products may lead to barriers of trade and unfair competition. Therefore, a harmonisation on the European level was necessary.[166] The overall goal of the Directive is to establish a framework for setting ecodesign requirements for specific product groups which should lead to reducing their environmental impact and to achieving energy and economic savings for businesses and end-users. Such products are, *inter alia*, products which use, generate, transfer, or measure energy, products used in construction such as windows, insulation materials or water-using products such as shower heads or taps.[167] The ecodesign criteria developed in the framework of this Directive must be fulfilled by products in order to be placed on the market and/or put into service.[168] This provision implies that all market actors, from the EU or from outside the EU, have to respect such criteria. Besides the predominant approach to improve the energy-efficiency of products in order to promote security of the energy supply, the reduction of the demand on natural resources in general is also named as a goal of the Directive.[169] However, as the Ecodesign Directive establishes only the framework to create ecodesign requirements for product groups, it is necessary to analyse under which

163 COM (2011) 571 final, p. 6 et seq.

164 Article 2(23) of Directive 2009/125/EC.

165 COM (2011) 571 final, p. 6.

166 Recital 2 of Directive 2009/125/EC.

167 Recital 4 in line with Article 1(1) of Directive 2009/125/EC.

168 Article 1(2) with Article 2(5) and (6), see also for the procedure Articles 3, 4 and 5 of Directive 2009/125/EC.

169 Recital 10 of Directive 2009/125/EC.

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procedures such requirements are to be developed. With this background it will be possible to assess the applicability of the procedure to the provisions of the resource-efficiency initiative concerning waste prevention and the ability to recover materials.

In general, ecodesign requirements are to be established through the committee procedure.[170] Article 15 defines three main criteria which have to be fulfilled by products to develop specific implementing measures:

(a) The product shall represent a significant volume of sales and trade (more than 200,000 units per year within the Community),

(b) It shall have a significant environmental impact within the EU,

(c) It shall present significant potential for improvement in terms of its environmental impact without entailing excessive costs.[171]

If a product meets these three criteria an implementing measure or a self-regulation measure can be developed.[172] In the following only the possibility of implementing measures as legal obligations will be taken into account. In this regard, Article 15 defines a complex procedure with a number of criteria which have to be fulfilled by setting ecodesign requirements. One criterion with a possible link to a material-oriented approach of ecodesign is that, by preparing a draft-implementing measure, the Commission shall consider the life cycle and all significant environmental aspects of a product.[173]

To define a concrete list of product groups for which ecodesign requirements shall be developed the Commission shall establish working plans.[174] Until 2012, 18 broad indicative product groups were identified and the Commission adopted 17 implementing measures for specific types of products between 2005 and 2011 (12 Ecodesign Regulations and 5 Energy Labeling Regulations).[175] Within the first working plan (2009-2011) eight product groups, *inter alia*, air-conditioning and ventilation systems, electric and fossil fuelled heating equipment and food preparing equipment were identified.[176] In a second working plan (2012-2014) nine product groups (to improve direct or indirect energy-efficiency) such as, for example, windows, steam boilers and power cables were identified.[177] As a result of an analysis of both working plans it is noted that requirements regarding, for example, the

170 Article 19 of Directive 2009/125/EC; see under section IV.3.a).

171 Article 15(2) of Directive 2009/125/EC.

172 Article 15(1) of Directive 2009/125/EC.

173 Article 4(a) of Directive 2009/125/EC.

174 Article 16(1) of Directive 2009/125/EC.

175 Working Plan 2012-2014 under the Ecodesign Directive, SWD (2012) 434 final, p. 3 et seq.

176 Establishment of the working plan for 2009-2011 under the Ecodesign Directive, COM (2008) 660 final, p. 4 et seqq.

177 Working Plan 2012-2014 under the Ecodesign Directive, SWD (2012) 434 final, p. 5 et seqq.

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ability to recover and re-usability or the use of recycled materials and limitation on the use of priority resources were not taken into account. That means that in the implementing measures, such criteria were identified as not relevant or efficient for the selected product categories.[178]

b) Linking Ecodesign and Material Resource-Efficiency

As the analysis above has shown, the Ecodesign Directive aims clearly to promote energy-efficiency by setting requirements for relevant product groups. The idea of a material-oriented interpretation in line with the resource-efficiency initiative could not be found in the two working plans. Such an approach should establish measures which are able to identify and implement strategies to promote re-usability and recyclability of specific products or materials. Furthermore, it should be assessed if an introduction of obligatory minimum rates of recycled materials in production process could be integrated.[179]

The provision that ecodesign requirements shall be laid down in accordance with Annex I and/or Annex II of the Ecodesign Directive, which define the methods to be used by developing such requirements,[180] could be a basis to establish more material-oriented ecodesign requirements within the framework of this Directive. In this regard, Annex I point 1.2 (environmental aspects to be assessed) defines that the expected generation of waste material and possibilities for re-use, recycling and recovery of materials should be taken into account by developing Ecodesign requirements.[181] Furthermore, point 1.3 of Annex I (parameters for evaluating the potential for improving the environmental aspects referred to in point 1.2) calls for promotion of the use of materials from recycling activities as well as the discouraging of technical solutions which hamper the re-use and recycling of components and whole appliances.[182]

Taking these points into consideration it seems possible to establish ecodesign requirements to promote material resource-efficiency within the framework of this Directive. However, as already discussed, the scope of the Directive refers to the promotion of energy-efficiency and to the protection of the environment. Nevertheless, the Commission is obliged to review the Directive in 2012.[183] This could be a chance to extend its scope and to include resource-oriented elements to

178 *Ardente/Wolf/Mathieux/Pennington*, Integration of resource efficiency and waste management criteria in the implementing measures under the Ecodesign Directive, Review of resource efficiency and end-of-life requirements, 2011, p. 38.

179 Ibid.

180 Article 15(6) of Directive 2009/125/EC.

181 Annex I, point 1.2(d) and (e) of Directive 2009/125/EC.

182 Annex I, point 1.3(b) and (h) of Directive 2009/125/EC.

183 Article 21 of Directive 2009/125/EC.

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ensure more material resource-efficiency through explicit requirements for specific products. Another option would be to design an independent directive related to waste prevention and recyclability by using the approach of product design using the EU's competence to harmonize the internal market. Within such a process, the Ecodesign Directive could be an example. Nevertheless, further analysis is necessary to answer the question of what would be the best way to implement the instrument of product design in order to promote the market for secondary raw materials and to facilitate re-use and recycling processes.

VI. Conclusion

As the analysis in chapter II has shown, the new political initiatives of the European Union call for a significant change concerning waste prevention and waste treatment operations. Besides the traditional connection of regulations for waste management in the field of environmental policy and legislation (environmental dimension), a new resource dimension and a climate dimension was introduced by the new policy initiatives.

The presented data in chapter III and in the Annex highlights the huge differences between the member states concerning the usage of methods of waste treatment. These methods vary from a landfill rate of treated and untreated waste close to 100 % in Romania to virtually 0 % in Germany and Sweden. Nevertheless, there exists a positive trend in the whole EU27 towards more material recycling and less landfilling operations while the amount of overall generated waste remains stable.

The basic analysis of the new waste hierarchy introduced by the new Waste Framework Directive presented in section IV.1 provides an orientation for all legislation concerning waste for both national and European authorities. In addition, the new hierarchy is flanked by concrete recycling and collection targets for specific waste materials on European level for the first time. Moreover, the new Waste Framework Directive provides several new instruments which can be used to improve waste management, *inter alia*, national waste prevention plans and the extended producer responsibility.

Chapter V focused on two specific examples of secondary European law. In section V.1, the possibilities to strengthen the European landfill legislation under the goal of eliminating landfilling in the Union were discussed. In this regard, it became clear that a revision of the Landfill Directive or an additional legislative act will be needed to create a legal framework with the aim of eliminating landfilling and to address the

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different usage levels of landfilling as a method of waste treatment in the member states.

Concerning the approach to lay down material-oriented requirements for specific products within the legal framework of the Ecodesign Directive to promote re-usability and recyclability of such products, section V.2 presented possible options. The general idea of implementing material-oriented efficiency criteria can be seen as a promising approach on the way to more sustainable material management in the EU.

As noted in the introduction of this study, it was one of the main goals to work out approaches to further develop Europe's waste legislation in line with the provisions of the European resource-efficiency initiative and the 7th EAP. Based on the research of this paper, three specific areas can be identified for further research to move up the waste hierarchy:

1. Developing a coherent legislative framework to ensure the elimination of land-filling in the European Union as the worst method of waste treatment regarding its environmental and climate impact and aspects of sustainable material use. Additionally, it should be ensured that incineration operations are limited to non-recyclable materials and that a future landfill ban for untreated waste does not create an overcapacity of incineration as it is now the case in countries like Germany and Sweden.
2. Further develop recycling targets and separate waste collection by assessing the practicability of incentives for innovative recycling and collection technologies and extended producer responsibility.
3. Establishing product design requirements to facilitate re-use and recycling processes of such products and to assess the possibility to introduce minimum standards for the usage of recycled materials within production processes.

It will be the aim of a follow-up study to investigate the potential to further develop the European legislation in these three areas. In this regard, it will be assessed if a common European waste management plan could be established to make the best use of existing waste treatment infrastructure and to coordinate new investments in the EU27. That could be necessary because within the common European internal market, all member states are affected by the environmental, the climate and the resource dimension of the future European waste management.

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VII. Annex – Waste Management Data for the European Union[184]

Table 1: Municipal waste generation and treatment in the EU27 from 1995 to 2010 (in kg per capita and percent)

	1995	2000	2005	2010
Total generation	474 / 100 %	523 / 100 %	516 / 100 %	502 / 100 %
Treated waste	434 / 92 %	500 / 96 %	498 / 97 %	486 / 97 %
Landfilling	296 / 62 %	288 / 55 %	220 / 43 %	186 / 37 %
Incineration	65 / 14 %	79 / 15 %	95 / 18 %	108 / 22 %
Recycling	46 / 10 %	78 / 15 %	105 / 20 %	121 / 24 %
Composting	28 / 6 %	55 / 11 %	78 / 15 %	72 / 14 %

Table 2: Municipal waste generation and treatment in Estonia from 1995 to 2010 (in kg per capita and percent)

	1995	2000	2005	2010
Total generation	371 / 100 %	462 / 100 %	436 / 100 %	311 / 100 %
Treated waste	370 / 100 %	449 / 97 %	373 / 86 %	261 / 84 %
Landfilling	368 / 99 %	439 / 95 %	274 / 63 %	188 / 60 %
Incineration	0 / 0 %	0 / 0 %	0 / 0 %	0 / 0 %
Recycling	0 / 0 %	9 / 2 %	90 / 21 %	37 / 12 %
Composting	2 / 1 %	1 / 0 %	8 / 2 %	24 / 8 %

184 Source: Eurostat Data Explorer from Municipal waste available under http://epp.eurostat.ec.europa.eu/portal/page/portal/waste/key_waste_streams/municipal_waste (15/11/2013).

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Table 3: Municipal waste generation and treatment in Germany from 1995 to 2010 (in kg per capita and percent)

	1995	2000	2005	2010
Total generation	623 / 100 %	642 / 100 %	565 / 100 %	583 / 100 %
Treated waste	529 / 85 %	609 / 95 %	553 / 98 %	583 / 100 %
Landfilling	245 / 39 %	165 / 26 %	48 / 8 %	2 / 0 %
Incineration	97 / 16 %	133 / 21 %	160 / 28 %	220 / 38 %
Recycling	119 / 19 %	218 / 34 %	251 / 44 %	260 / 55 %
Composting	67 / 11 %	92 / 14 %	93 / 16 %	101 / 17 %

Table 4: Municipal waste generation and treatment in Greece from 1995 to 2010 (in kg per capita and percent)

	1995	2000	2005	2010
Total generation	- / -	407 / 100 %	437 / 100 %	457 / 100 %
Treated waste	328 / -	407 / 100 %	437 / 100 %	457 / 100 %
Landfilling	- / -	372 / 91 %	387 / 89 %	374 / 82 %
Incineration	- / -	0 / 0 %	0 / 0 %	0 / 0 %
Recycling	- / -	33 / 8 %	49 / 11 %	79 / 17 %
Composting	- / -	1 / 0 %	3 / 1 %	4 / 1 %

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Table 5: Municipal waste generation and treatment in the Netherlands from 1995 to 2010 (in kg per capita and percent)

	1995	2000	2005	2010
Total generation	548 / 100 %	613 / 100 %	624 / 100 %	595 / 100 %
Treated waste	518 / 95 %	525 / 86 %	518 / 83 %	499 / 84 %
Landfilling	157 / 29 %	57 / 9 %	11 / 2 %	2 / 0 %
Incineration	138 / 25 %	190 / 31 %	202 / 32 %	194 / 33 %
Recycling	92 / 17 %	134 / 22 %	156 / 25 %	164 / 28 %
Composting	130 / 24 %	145 / 24 %	149 / 24 %	138 / 23 %

Table 6: Municipal waste generation and treatment in Poland from 1995 to 2010 (in kg per capita and percent)

	1995	2000	2005	2010
Total generation	285 / 100 %	318 / 100 %	319 / 100 %	315 / 100 %
Treated waste	285 / 100 %	318 / 100 %	245 / 77 %	263 / 83 %
Landfilling	279 / 98 %	311 / 98 %	226 / 71 %	193 / 61 %
Incineration	0 / 0 %	0 / 0 %	1 / 0 %	3 / 1 %
Recycling	0 / 0 %	0 / 0 %	10 / 3 %	47 / 15 %
Composting	5 / 2 %	6 / 2 %	8 / 3 %	21 / 7 %

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Table 7: Municipal waste generation and treatment in Romania from 1995 to 2010 (in kg per capita and percent)

	1995	2000	2005	2010
Total generation	342 / 100 %	355 / 100 %	378 / 100 %	365 / 100 %
Treated waste	254 / 74 %	295 / 83 %	303 / 80 %	294 / 81 %
Landfilling	254 / 74 %	295 / 83 %	296 / 78 %	290 / 79 %
Incineration	0 / 0 %	0 / 0 %	0 / 0 %	0 / 0 %
Recycling	0 / 0 %	0 / 0 %	7 / 2 %	4 / 1 %
Composting	0 / 0 %	0 / 0 %	0 / 0 %	0 / 0 %

Table 8: Municipal waste generation and treatment in Spain from 1995 to 2010 (in kg per capita and percent)

	1995	2000	2005	2010
Total generation	510 / 100 %	658 / 100 %	592 / 100 %	535 / 100 %
Treated waste	368 / 72 %	494 / 75 %	525 / 89 %	535 / 100 %
Landfilling	308 / 60 %	337 / 51 %	290 / 49 %	310 / 58 %
Incineration	24 / 5 %	36 / 5 %	44 / 7 %	49 / 9 %
Recycling	36 / 7 %	44 / 7 %	85 / 14 %	81 / 15 %
Composting	0 / 0 %	77 / 12 %	101 / 17 %	96 / 18 %

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Table 9: Municipal waste generation and treatment in Sweden from 1995 to 2010 (in kg per capita and percent)

	1995	2000	2005	2010
Total generation	386 / 100 %	428 / 100 %	481 / 100 %	465 / 100 %
Treated waste	385 / 100 %	425 / 100 %	492 / 100 %	460 / 99 %
Landfilling	136 / 35 %	97 / 23 %	23 / 5 %	4 / 1 %
Incineration	148 / 38 %	168 / 39 %	242 / 50 %	226 / 49 %
Recycling	77 / 20 %	123 / 29 %	174 / 36 %	166 / 36 %
Composting	24 / 6 %	41 / 10 %	54 / 11 %	63 / 14 %

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