Northern Ireland Assembly

Research and Information Service Briefing Paper

Paper 11/17 12 January 2017 NIAR 485-16

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Recycling in Germany

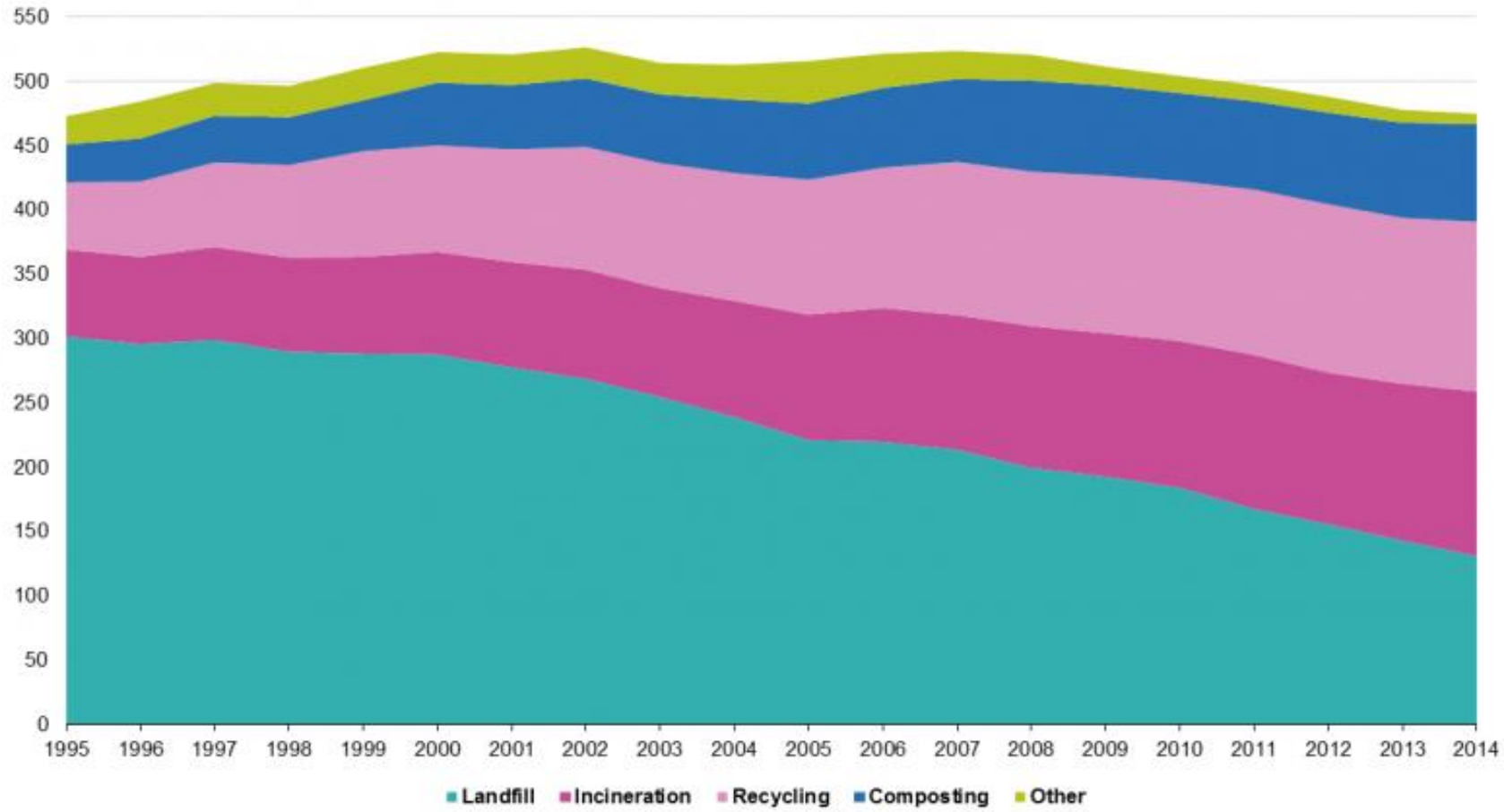
1 Introduction

The Committee asked for information on the recycling model in Germany. The paper provides an overview of the current state of recycling in Germany and the policy behind the approach used. It also explores the concept of 'zero waste' and how this is used to drive down waste levels and encourage recycling in countries adopting it.

2 Background

In Europe as a whole, the treatment of waste over the past 20 years approximately has been dominated by landfill. However, the last 10 years, particularly, have seen the gradual increase of other methods such as incineration, recycling and composting and the decrease of landfilling, as shown in Fig 1. By 2014, 28% of municipal waste generated was recycled, 28% also landfilled, 27% incinerated and 16% composted.

Figure 1: Municipal Waste Treatment, EU-27 (kg per capita)



Source: Eurostat 2016[1]

[1] Eurostat (March 2016) **Municipal waste treatment, EU-27, (kg per capita)**
http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Municipal_waste_treatment,_EU-27,_(kg_per_capita)_new.png

2.2 Waste management in Germany

Germany is the third largest producer of municipal waste in the EU (and behind Switzerland), generating 618 kg per person in 2014, as shown in Figure 2. However, Germany has a high treatment rate and only landfilled 1% of municipal waste in 2014. Almost half, 47%, went to recycling, 17% to composting and 35% to incineration.[2]

Responsibility for waste management is shared between the national Government, the Federal States and local authorities. The National Ministry of Environment[3] sets priorities, drafts national legislation, oversees any strategic planning and information, and defines requirements for waste facilities.

In line with national legislation, Federal States adopt their own waste management act giving a more regional perspective on approaches and rules for waste management and disposal. Waste management plans are also produced at the regional level by Federal States.[4]

Local authorities (mostly districts and towns) have responsibility for household waste under the Recycling Management and Waste Act. This includes collecting, transporting waste, measures to promote waste prevention and recovery, and the construction and operation of waste disposal facilities. Municipalities (mostly part of a district) provide sites for waste collection.[5]

The centrepiece of legislation for waste management across Germany is the Waste Management Act 2012. This lays out the waste hierarchy for Germany which begins with prevention, reuse, recycling and recovery, and finally disposal. Therefore, waste management practices in Germany aim to minimise waste generation and maximise recycling, while ensuring that any leftover waste is disposed of appropriately. It is from this Act that Federal States develop their own acts. According to Germany's Environment Protection Agency (the UBA)[6], Federal States only have jurisdiction over areas not already regulated by the national government. On this basis Federal acts do not regulate waste disposal but merely address implementation such as identifying authorising bodies, who must comply, and developing municipal disposal ordinances.[7]

[2] Eurostat (2016) http://ec.europa.eu/eurostat/documents/2995521/7214320/8-22032016-AP-EN.pdf/eea3c8df-ce89-41e0-a958-5cc7290825c3

[3] National Ministry of Environment http://www.bmub.bund.de/en/topics/water-waste-soil/

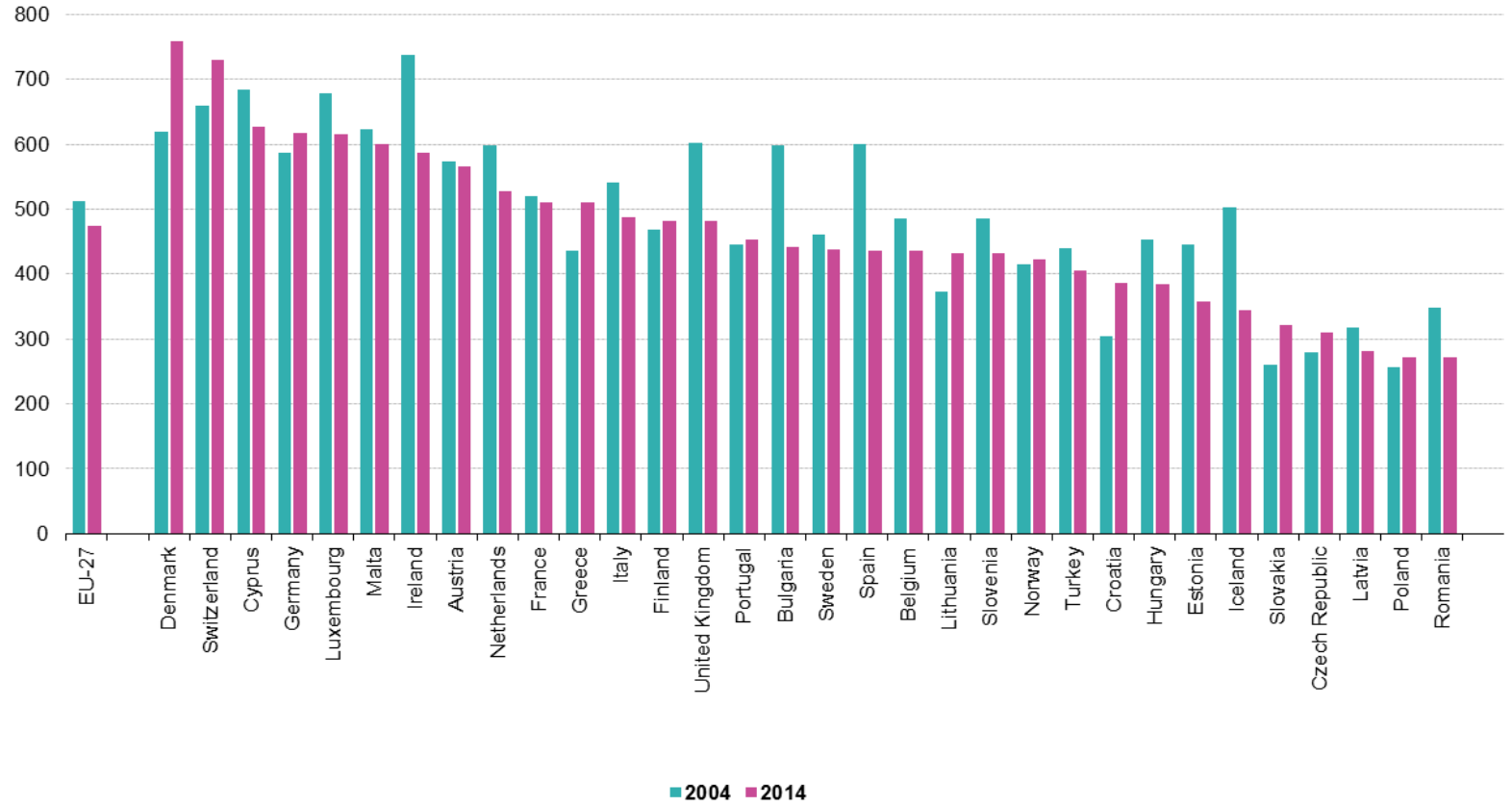
[4] EEA, 2013, Municipal Waste Management in Germany p.5. Available at http://www.eea.europa.eu/publications/managing-municipal-solid-waste

[5] ibid

[6] UBA http://www.umweltbundesamt.de/en/the-uba/about-us

[7] UBA http://www.umweltbundesamt.de/en/topics/waste-resources/waste-management/waste-regulations

Figure 2: Municipal waste generated by country in 2004 and 2014, sorted by 2014 level (kg per capita)



Source: Eurostat 2016[8]

[8] Eurostat (March 2016) ***Municipal waste generated by country in 2004 and 2014, sorted by 2014 level (kg per capita)*** http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Municipal_waste_generated_by_country_in_2004_and_2014,_sorted_by_2014_level_(kg_per_capita).png

3 Recycling in Germany

According to the European Environment Agency (2013), Germany was one of the first European countries to introduce landfill limiting policies in the 1990s. These included schemes for collecting packaging waste, bio-waste and waste paper separately. By 2001, Germany recycled about 48% of its municipal waste (just above NI's current level of 46.2% (as of June 2016)).[9] This increased to 62% in 2010 (well beyond the EU 2020 target of 50%), landfilling was almost 0% and incineration 37%.[10] See Fig 3.

Eurostat data for 2014 shows that Germany has the highest recycling and compost rate for municipal waste of all EU Member States, at 64%[11]. However, removing composting from the equation, Germany's material recycling rate alone is 47%, just behind Slovenia at 49%, showing that Germany also has a strong approach to composting.[12]

Germany has experienced year on year growth of overall recycling since 2001, in fact, as shown in Fig 4, by the early 2000s, Germany had met and surpassed the EU 2020 target of 50%.

The German Government has in fact set an ambitious target:

> *"to achieve almost complete high-quality recovery, at least of municipal waste, by 2020."*[13]

However, it should be noted that Germany's sharp growth in recycling slowed by the latter part of the 2000s as shown in Fig 4, and continues to do so. For example, Germany reached 64% back in 2008, and has fluctuated a degree or two since then to remain at 64% in 2014[14]. For this reason, future projections by the EEA indicate that efforts will need to be continued to maintain and increase Germany's already high recycling rates.[15]

[9] EEA, 2013, Municipal Waste Management in Germany. Available at http://www.eea.europa.eu/publications/managing-municipal-solid-waste

[10] ibid

[11] Eurostat (2016) *Each person in the EU generated 475 kg of municipal waste in 2014* http://ec.europa.eu/eurostat/documents/2995521/7214320/8-22032016-AP-EN.pdf/eea3c8df-ce89-41e0-a958-5cc7290825c3

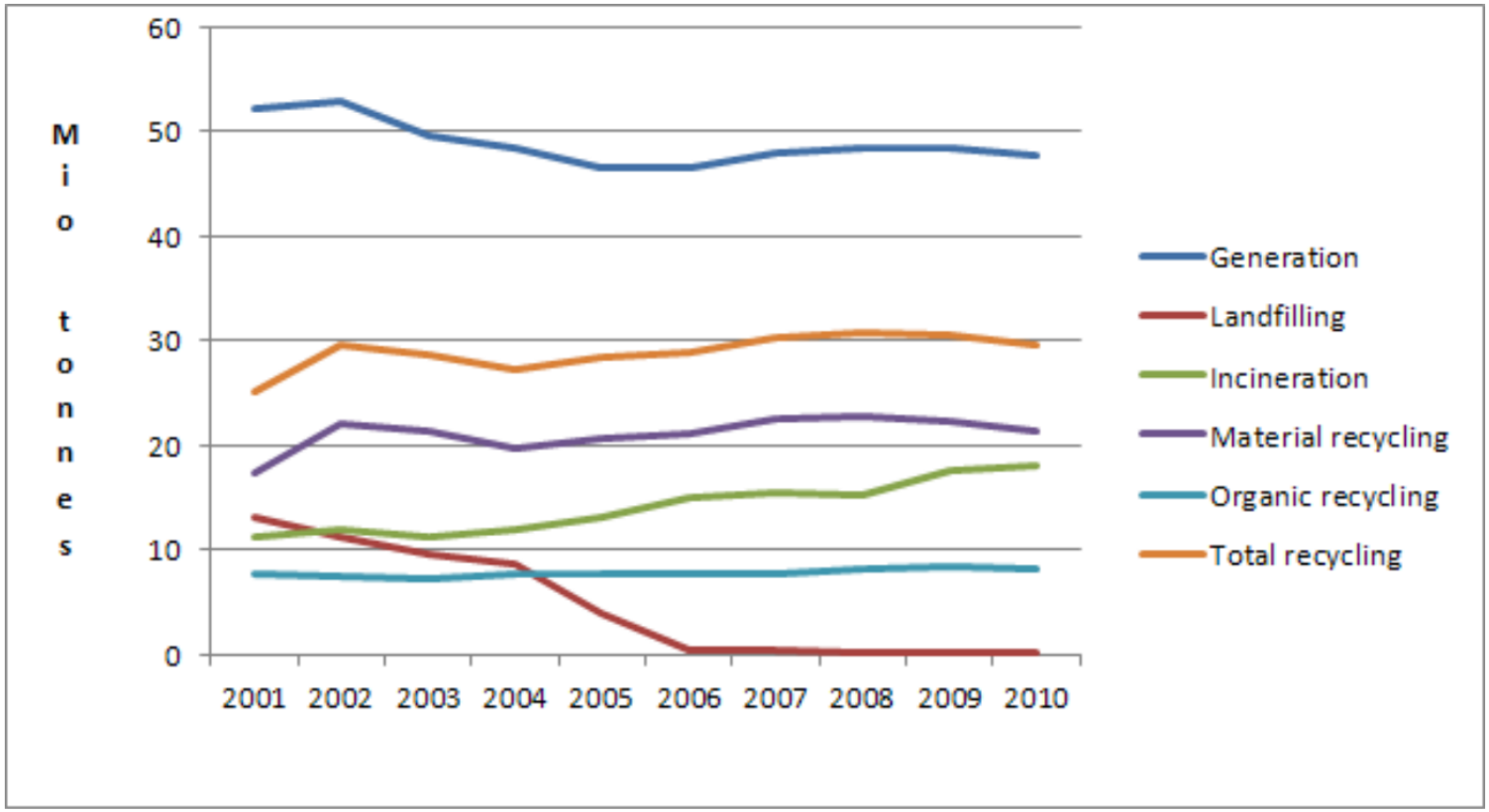
[12] ibid

[13] http://www.bmub.bund.de/en/topics/water-waste-soil/waste-management/general-information/

[14] Eurostat (2016) *Each person in the EU generated 475 kg of municipal waste in 2014* http://ec.europa.eu/eurostat/documents/2995521/7214320/8-22032016-AP-EN.pdf/eea3c8df-ce89-41e0-a958-5cc7290825c3

[15] EEA, 2013, Municipal Waste Management in Germany p.8. Available at http://www.eea.europa.eu/publications/managing-municipal-solid-waste

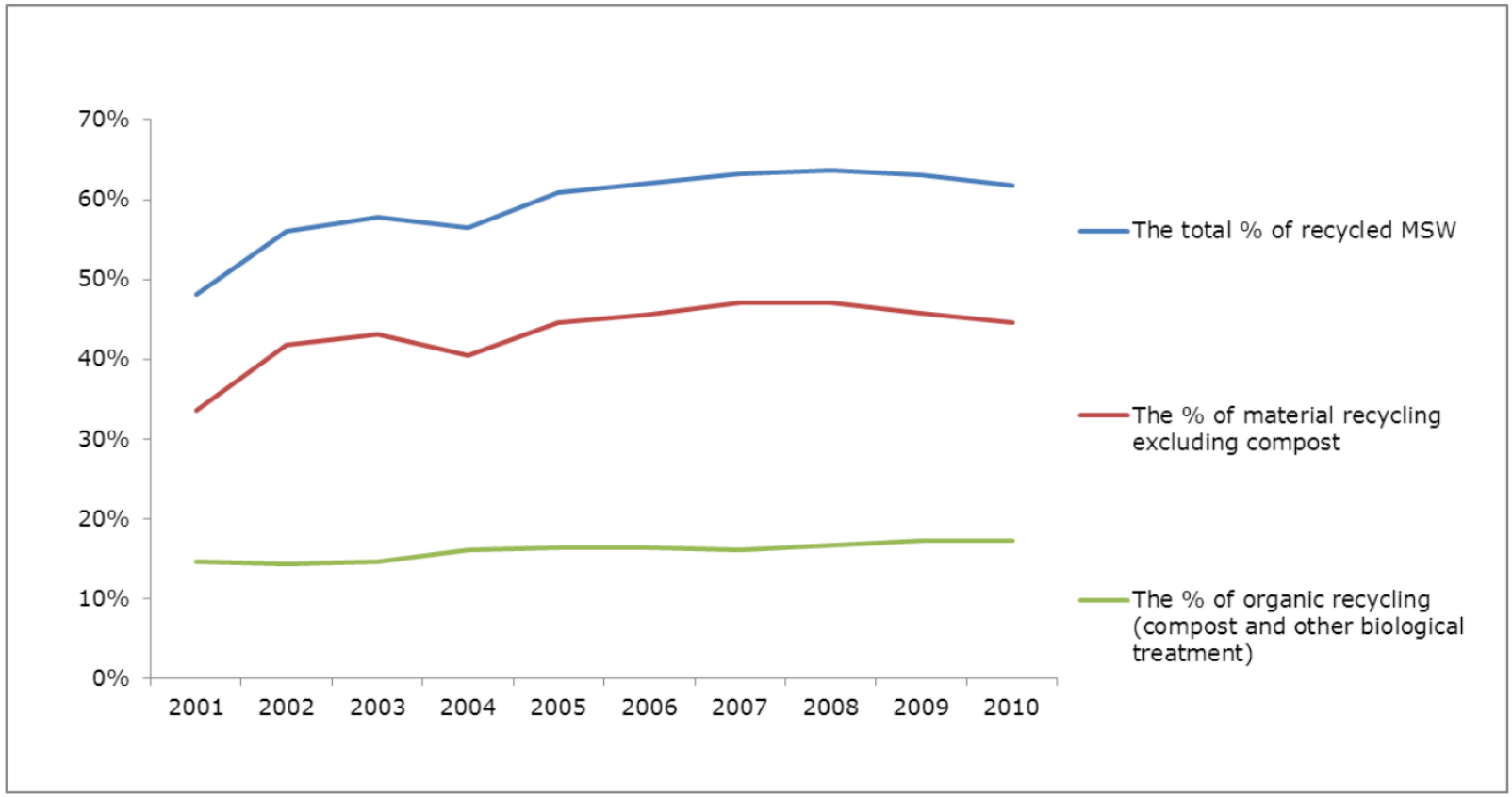
Figure 3: Development of landfilling, incineration and recycling of MSW in Germany (Stated in million tonnes).



Source: EEA (2013)[16]

[16] EEA, 2013, Municipal Waste Management in Germany p.7. Available at http://www.eea.europa.eu/publications/managing-municipal-solid-waste

Figure 4: Recycling of MSW in Germany



Source: EEA (2013)[17]

[17] EEA, 2013, Municipal Waste Management in Germany p.7. Available at http://www.eea.europa.eu/publications/managing-municipal-solid-waste

3.1 Initiatives

Germany's high recycling rates are driven by its policy and initiatives to waste management. EU legislation under the Waste Framework Directive, for example, sets the policy framework and targets for recycling in Germany. However, like all EU Member States, how those targets are met is left up to the approaches adopted nationally. On this basis, the following section looks at the policy and initiatives used by Germany that may have directly or indirectly resulted in Germany's high recycling performance.

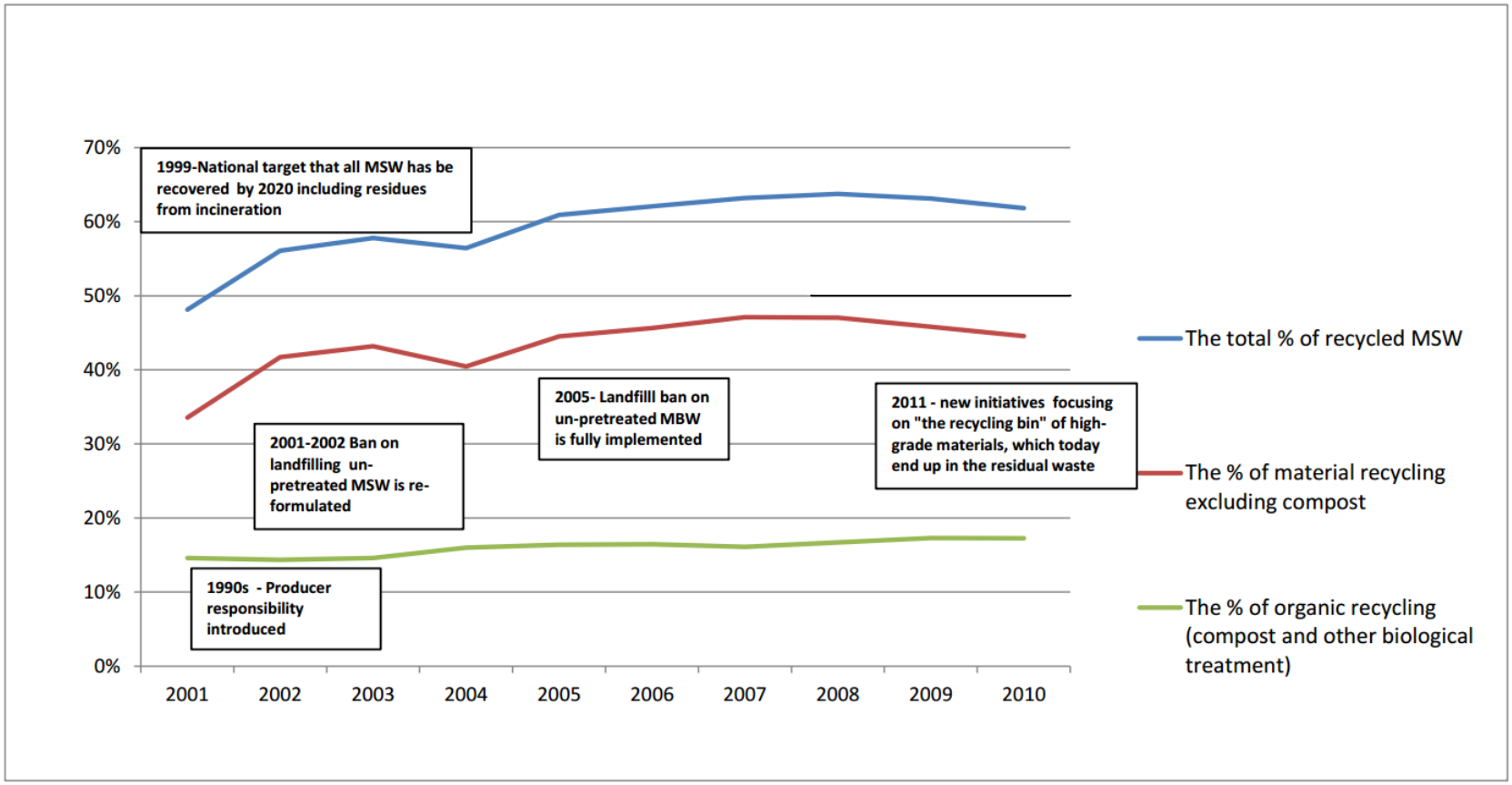
Germany has a long history of national waste strategies and waste management plans at the federal state level that pre-dated the WFD 2008. Before the WFD (2008) was introduced, Germany had signalled a major shift in thinking away from waste disposal and landfilling, to waste minimisation, avoidance and recovery dating back to the 1990s. For example, Germany was one of the first European countries to limit landfilling, introduce schemes for collecting packaging waste, bio-waste and waste paper separately.[18] Some of these dated back to the early 1990s and resulted in a recycling rate for municipal waste of 48% by 2001. In fact, by the time the WFD was introduced in 2008, Germany already had a head start with a recycling rate of around 60%.

According to the EEA, a ban on landfilling un-pretreated municipal waste, producer responsibility and a focus on separate collection have proven to be important policy initiatives for successful recycling rates in Germany.[19] With this in mind, the following section considers some of these initiatives which are illustrated in Fig 5.

[18] Ibid p.6

[19] EEA, 2013, Municipal Waste Management in Germany p.8. Available at http://www.eea.europa.eu/publications/managing-municipal-solid-waste

Figure 5: Important policy initiatives in Germany for recycling municipal solid waste (MSW)



Source: EEA (2013)[20]

[20] EEA, 2013, Municipal Waste Management in Germany p.16. Available at http://www.eea.europa.eu/publications/managing-municipal-solid-waste

3.1.1 Producer Responsibility

According to the National Ministry for Environment, producer responsibility signalled the major shift in Germany from waste disposal to waste avoidance and recovery and provided the necessary paving stone for recycling initiatives. Germany was the first EU country to introduce producer responsibility for waste packaging in 1991, under the Packaging Ordinance. [21] This requires product manufacturers to take back packaging they have placed on the market and re-use it or recycle its constituent materials, or have this done by a third party (known as Extended Producer Responsibility, through an EPR Scheme).[22]

Producer responsibility policies were extended through the Closed Substance Cycle and Waste Management Act 1996. This Act strengthened waste prevention and recovery and was one of the legislative vehicles through which the WFD was implemented. Since its enforcement, the Act ensured that producers and distributors design their products in such a way that increases their service life, reduces waste occurrence during their production and use and allows for the environmentally sound recovery and disposal of any residual substances. This means that the industry and commercial sector are held responsible for the recovery of waste and must bear the costs.[23]

Further ordinances were introduced for other products such as used oil (Waste Oil Ordinance); batteries (Batteries Act); old vehicles (End-of-Life Vehicle Ordinance); electrical and electronic equipment (Electrical and Electronic Equipment Act[24]), waste wood and underground waste disposal ordinances. [25]

However, construction and demolition waste rely on voluntary commitments made by the sector.[26] That being said, commitments under the voluntary agreement have been met and the National Ministry of Environment details that as of 2012, 86% of construction waste has been recycled.[27]

[21] EEA, 2013, Municipal Waste Management in Germany p.5. Available at http://www.eea.europa.eu/publications/managing-municipal-solid-waste

[22] EC study "**Assessment of separate collection schemes in the 28 capitals of the EU**"

[23] UN Sustainable Development Commission (2010) National Report Germany- Waste. Available from https://sustainabledevelopment.un.org/content/dsd/dsd_aofw_ni/ni_pdfs/NationalReports/germany/waste.pdf and National Ministry of Environment http://www.bmub.bund.de/en/topics/water-waste-soil/waste-management/waste-policy/product-responsibility/

[24] National Ministry of Environment (BMUD) [online] Electrical and Electronic waste http://www.bmub.bund.de/en/topics/water-waste-soil/waste-management/types-of-waste-waste-flows/waste-electrical-and-electronic-equipment/

[25] National Ministry of Environment http://www.bmub.bund.de/en/topics/water-waste-soil/waste-management/types-of-waste-waste-flows/production-waste/

[26] National Ministry of Environment (BMUD) {online] Construction Industry http://www.bmub.bund.de/en/topics/water-waste-soil/waste-management/types-of-waste-waste-flows/construction-waste/

[27] National Ministry of Environment (BMUD) [online] Waste Policy Background http://www.bmub.bund.de/en/topics/water-waste-soil/waste-management/waste-policy/

Example: Batteries

Waste batteries for appliances may be returned to retail outlets at no cost to the consumer. Municipalities also offer to dispose of batteries at recycling centres or mobile pollutant collection centres.

Manufacturers have also established a joint return system (Stiftung Gemeinsames Rücknahmesystem Batterien – GRS). These use third party contractors, such as logistics and disposal companies which take back batteries for them, therefore fulfilling their producer responsibilities in relation to the collection, recycling and sound disposal of waste batteries. [28]

3.1.2 Deposit Scheme

In 2003 a mandatory one-way deposit scheme for refillable drinks packaging was introduced. A 25 eurocents deposit is payable on all refillable and non-ecologically favourable packing for mineral water, beer, soft drinks and alcoholic mixed drinks. According to Zero Waste Europe, this resulted in one of the most successful deposit schemes in the world, with 98.5% of refillable bottles being returned by consumers[29]. The purpose of this scheme was to do away with the on-way use of products and the "throw away" mentality. A study by B. Simon et al (2015) found that the environmental impacts of refillable bottles decrease with the increased number of refills, due to the reduced demand for primary materials in bottle production[30]. Another study, by the IFEU Institute (Institute for Energy and Environmental Research), found that refillable bottles have 50-60% lower global warming potential than one-way beverage containers.[31]

3.1.3 Ban on landfilling un-pretreated MSW

Initiatives in relation to banning certain types of un-treated municipal waste going to landfill were introduced back in 1993[32]. However, in 2005 Germany implemented provisions on landfills that go beyond the requirements of the EU Landfill Directive.[33] Since 2005, untreated residual household and industry waste has been banned from landfills in Germany. Waste going to landfill must be pre-treated in mechanical-

[28] http://www.bmub.bund.de/en/topics/water-waste-soil/waste-management/types-of-waste-waste-flows/waste-batteries/

[29] Zero Waste Europe (2010) https://www.zerowasteeurope.eu/2010/09/beverage-packaging-and-zero-waste/

[30] B. Simon, M.B. Amor and R. Foldenyi (2015) *Life cycle impact assessment of beverage packaging systems: focus on the collection of post-consumer bottles.* Journal of Cleaner Production 112 (2016) 238-248. P.244. Available at Science Direct http://www.sciencedirect.com/science/article/pii/S0959652615007209

[31] Zero Waste Europe (2010) https://www.zerowasteeurope.eu/2010/09/beverage-packaging-and-zero-waste/

[32] EEA, 2013, Municipal Waste Management in Germany p.15. Available at http://www.eea.europa.eu/publications/managing-municipal-solid-waste

[33] UN Sustainable Development Commission (2010) National Report Germany- Waste. Available from https://sustainabledevelopment.un.org/content/dsd/dsd_aofw_ni/ni_pdfs/NationalReports/germany/waste.pdf

biological treatment plants. This is to prevent any biological conversion processes from occurring so as to reduce landfill gas. According to the National Ministry for Environment, this has led to a reduction of more than 30 million tonnes of carbon dioxide equivalents per year in Germany over the last 15 years.[34]

In 1999 the German government also committed itself to completely recover all municipal waste by 2020, so as to remove the need to landfill municipal waste and treatment residues. This has been described by the EEA as an ambitious target which also includes dedicated energy recovery of waste incineration residues.[35]

3.1.4 Separate collection of waste

Articles 10 and 11 of the WFD sets out he general requirements for the separate collection of waste and required Member States to set up systems for at least paper, metal, plastic and glass by 2015. Member states are at liberty to use whatever form of separate collection of their choice, provided they are in line with the requirements stipulated under these articles.

There are a variety of ways to collect different waste streams and a study commissioned by the European Commission and performed by Bipro in 2015 assessed separate collection schemes across the 28 capitals of the EU[36]. According to this study:

> *Separate collection of individual waste fractions is seen as a pre-condition for fostering high quality recycling and high recycling rates[37].*

The study found that on average only 19% of municipal waste is collected separately across the 28 EU capitals, with 80% going to the residual waste bin. In comparison, Germany was represented by Berlin with the eighth highest capture rate for paper, plastic, metal, glass and bio-waste using separate collection, as shown in Fig 5.

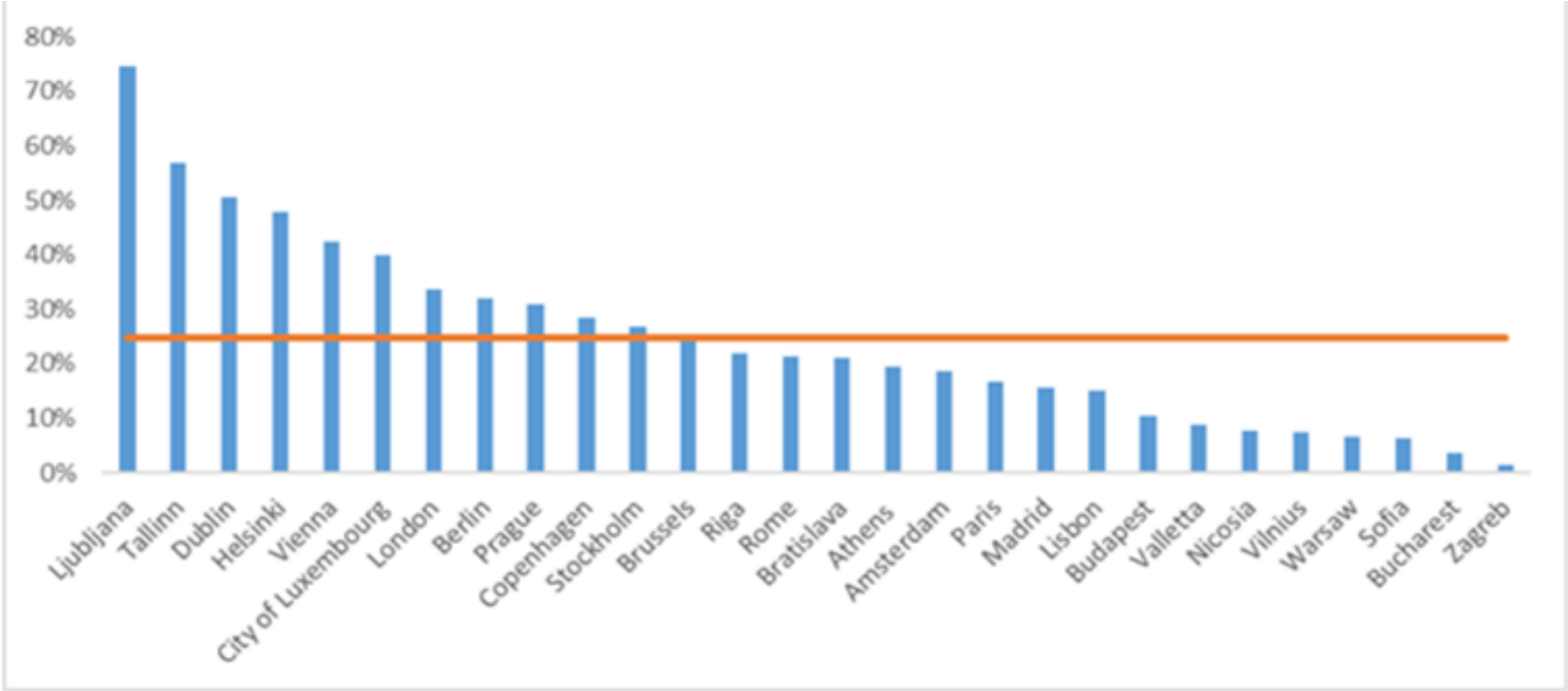
[34] National Ministry of Environment http://www.bmub.bund.de/en/topics/water-waste-soil/waste-management/waste-policy/

[35] EEA, 2013, Municipal Waste Management in Germany p.15. Available at http://www.eea.europa.eu/publications/managing-municipal-solid-waste

[36] Bipro on behalf of EU Commission (2015) *Assessment of separate collection schemes in the 28 capitals of the EU*. http://ec.europa.eu/environment/waste/studies/pdf/Separate%20collection_Final%20Report.pdf

[37] ibid

Figure 5: Combined capture rate for paper, metal, glass, plastic and bio-waste for EU-28 capitals



Source: Bipro 2015[38]

[38] Bipro on behalf of EU Commission (2015) *Assessment of separate collection schemes in the 28 capitals of the EU*. http://ec.europa.eu/environment/waste/studies/pdf/Separate%20collection_Final%20Report.pdf

The Kreislaufwirtschaftsgesetz"(*Circular Economy Act,* KrWG) was adopted in Germany in 2012 and transposed the requirements of the WFD in relation to separate collection of paper, glass, metal and plastic. However, it goes a step further than the WFD by introducing the separate collection of bio-waste, setting it apart from other EU Member States in this regard, including NI. Germany operates systems for the separate collection of the five waste under the WFD, plus bio-waste.

Similarly, Germany provides for the separate collection of other waste under a number of pieces of legislation and ordinances, some of which include old clothes, packaging, electrical and electronic waste, batteries and hazardous waste.[39]

Example: Packaging Ordinance

This Ordinance has already been considered under section 2.2.1 in respect to producer responsibility. However, the Ordinance (as amended) also transposes the requirements of the EU Directive on packaging and packaging waste by providing for the separate collection and specific recycling and recovery targets for packaging.

The European Commission's Bipro study found that the main approach used by Germany for the primary systems (paper, glass, plastic, metal, bio-waste) were a mixture of door to door separate collection of paper and bio-waste, co-mingled collection of plastic and metal and bring points for glass.[40]

The separate collection of waste is administered using a number of different colour coded bins found at residential homes, university campus and public places such as train stations. While the colours of bins may vary according to different districts within Germany, the following section gives a general description of bins and materials collected[41]:

- **Black bin** for residual waste – this is left over non- hazardous waste that cannot be recycled.
- Blue paper barrel – Paper, cardboard, magazines, leaflets, books, and carton packaging are collected here. There are also collection points available where paper and cardboard can be exchanged for money according to its weight in kilograms.
- Brown or green bin for organic/bio-waste - Organic waste such as leftovers, fruit and vegetable waste, egg, nutshells, coffee filters, tea bags, and garden waste like greenery and grass clippings, belong here.

[39] UN Sustainable Development Commission (2010) National Report Germany- Waste. Available from https://sustainabledevelopment.un.org/content/dsd/dsd_aofw_ni/ni_pdfs/NationalReports/germany/waste.pdf

[40] Bipro Report http://ec.europa.eu/environment/waste/studies/pdf/Separate%20collection_Final%20Report.pdf

[41] This information was taken from a combination of online sources, including travel websites e.g. http://www.howtogermany.com/pages/recycling.html , university sites e.g. http://www.study-in-chemnitz.com/en/Living/Waste_separation__2299.html and general information sites e.g. http://livingdreams.tv/environment/how-to-recycle-trash-in-germany-easier-think (2014)

- Yellow Recycle bin or bag – this is known as the "Gelbe Tonne" or "Gelbe Sack". All recyclable material and packaging such as empty tins, plastic packages or beverage cartons belong here. Bags are available free from town halls, or may be bought from supermarkets. However, according to EEA (2013) Germany was considering introducing a new bin known as the "recycle bin" to replace the yellow bin. The new bin would separate out recyclables even further into plastic and metal so as to increase the recycling of these material.[42]
- Glass/bottle banks – used glass is collected in bottle banks. However reusable bottles, both plastic and glass e.g. beer bottles, are not allowed in the bottle banks and fall under the deposit scheme where 25 eurocents are payed for returned bottles. Deposit bottles can also be identified by a logo. Bottle caps must be removed and put in the recycling bin.
- Batteries – batteries are collected separately in small boxes available from and returned to shops and supermarkets. The shops and supermarkets them dispose of them properly.

There is a charge on waste in Germany where each bin has a bar code and is read at the point of pick up. The cost per consumer is calculated by weight where food waste and recycling has a very low per pound fee, and remaining garbage a very high per pound fee.[43]

Once collected, separately collected waste is recycled by producers or by private or public sector agencies. Waste is further sorted using a refined detector system based on infrared technology. This helps to separate waste further, for example into different types of plastic.[44]

According to the charity organisation *We Future Cycle*[45], the key to the success of Germany's separate collection scheme is the fact that Germany applied a consistent scheme across the country with the same types of bins for all, including households and business[46]. Other factors mentioned include:

1. consistent signage, consistent colours of bins
2. supervision at point of collection (stickers identifying wrong materials, fines for non-compliance)
3. pay per throw via bar code where cost differentiates by the material.
4. Bio Digesters for food waste management.

[42] EEA, 2013, Municipal Waste Management in Germany p.5. Available at http://www.eea.europa.eu/publications/managing-municipal-solid-waste

[43] This information was taken from a combination of online sources, including travel websites e.g. http://www.howtogermany.com/pages/recycling.html , university sites e.g. http://www.study-in-chemnitz.com/en/Living/Waste_separation__2299.html and general information sites e.g. http://livingdreams.tv/environment/how-to-recycle-trash-in-germany-easier-think (2014)

[44] UN Sustainable Development Commission (2010) National Report Germany- Waste. Available from https://sustainabledevelopment.un.org/content/dsd/dsd_aofw_ni/ni_pdfs/NationalReports/germany/waste.pdf

[45] We Future Cycle [online] *About Us* https://wefuturecycle.com/about-2/

[46] We Future Cycle https://wefuturecycle.com/2015/07/15/waste-management-in-germany-87-recycling-rate/

Bio-waste

One of the latest introductions in Germany has been the separate collection of bio-waste since 2015 under the Bio-waste Ordinance. This goes beyond the requirements of the WFD, of which Article 22 only require measures to "encourage" the separate collection of bio-waste.[47] Under the Ordinance, bio-bins must be provided to all German households for the separate collection of garden and food waste. This ensures that only biodegradable waste with a low pollutant content is utilised as a source material for fertilisers or soil improvers, for example, after composting or fermentation. The aim is to recycle organic material and to avoid the accumulation of pollutants in the soil. The National Ministry of Environment states that composts from separately collected bio-waste bins contain 95% less contaminants than composts produced from mixed household waste.[48]

Schuch and Morscheck et al (2015) explain further that the separate collection of bio-waste produces high quality compost and digestate suitable for agricultural or horticultural use. It also ensures that left over residual household waste is less contaminated and wet, therefore making sorting, recycling and incineration more efficient. According to Schuch and Morscheck et al, biodegradable waste in landfills is the main factor for the generation of the greenhouse gas methane. In effect, the recycling of compost and digestate on soils and the energy recovery of bio-waste, contribute to climate protection and resource conservation. [49]

Sewage sludge

In a similar vein, sewage sludge (including domestic sewage) from local authority sewage treatment plants contains high levels of phosphorous. Phosphorus has been recognised by the European Commission as a critical raw material and was added to its list (as phosphate rock) in 2014[50]. According to the National Ministry of Environment, currently almost half of municipal sewage sludge is used as fertiliser in agriculture and landscaping. The remaining sewage sludge is used as a secondary fuel in power plants and cement works or is disposed of in landfills once pre-treated.[51] The German government is in fact promoting techniques for the further sustainable management and conservation of this material under its Resource Efficiency Programme (ProgRess).[52]

[47] WFD http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008L0098

[48] National Ministry of Environment (BMUD) [online] Organic Waste http://www.bmub.bund.de/en/topics/water-waste-soil/waste-management/types-of-waste-waste-flows/organic-waste/

[49] A, Schuch and , Morscheck et al (2015) *Bio-Waste Recycling in Germany – Further Challenges.* Procedia Environmental Sciences 35 (2016) 308 – 318. Available from Science Direct.

[50] European Commission https://ec.europa.eu/growth/sectors/raw-materials/specific-interest/critical_en

[51] National Ministry of Environment http://www.bmub.bund.de/en/topics/water-waste-soil/waste-management/types-of-waste-waste-flows/sewage-sludge/

[52] National Ministry of Environment http://www.bmub.bund.de/en/topics/economy-products-resources-tourism/resource-efficiency/german-resource-efficiency-programme/overview/

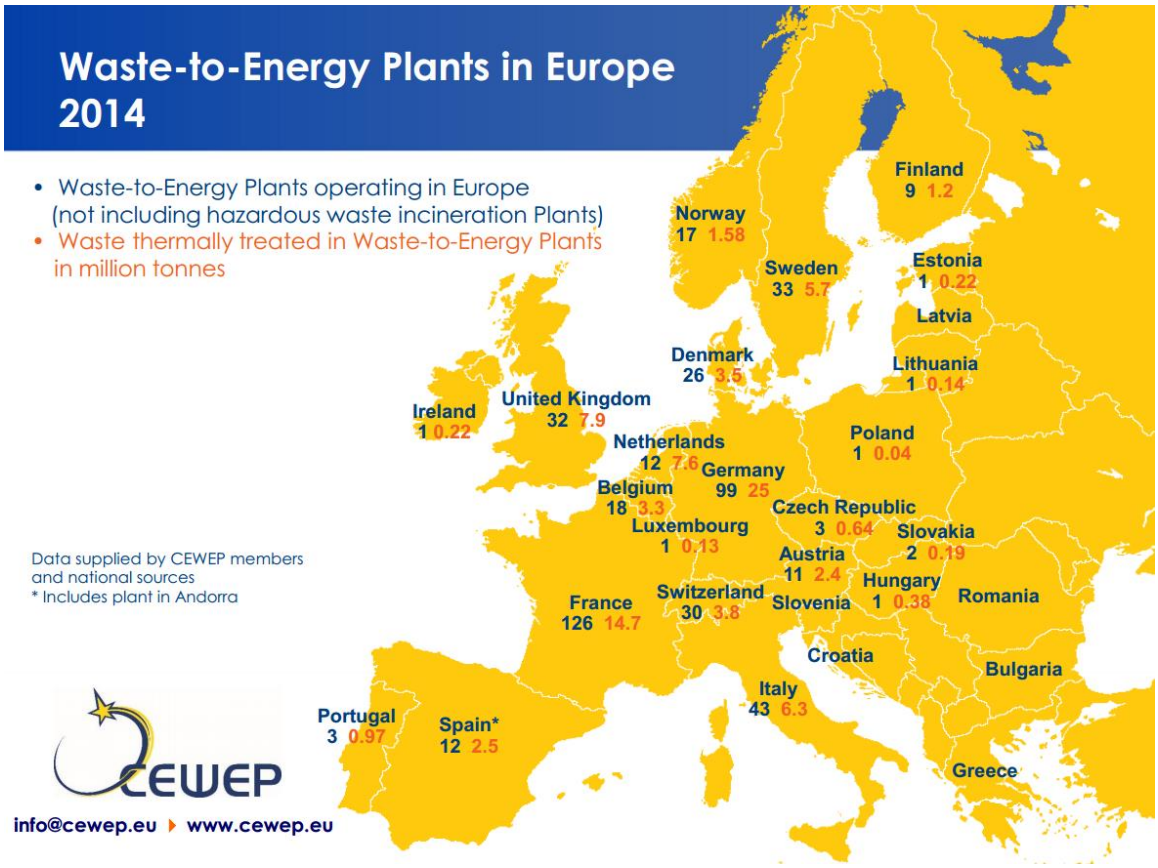
3.1.5 Incineration

Waste to energy plants, or incinerators, burn household and similar waste after prevention and recycling. The plants generate energy from this in the form of steam, electricity or hot water. This electricity is fed into the grid and distributed to the end users. Hot water can be sent to a nearby district heating (or cooling) network to heat (or cool) homes, hospitals, offices etc., and steam can be used by nearby industry in production processes.

More information on the process and technology is available from the Confederation of European Waste to Energy Plants (CEWEP).

In Germany, as of 2014, there are 99 waste to energy plants operating (not including hazardous waste incineration plants), second highest in the EU, with the highest treatment rate of 25 million tonnes. This compares to the UK with 32 plants, treating 7.9 million tonnes and the Republic of Ireland with 1 plant treating 0.22 million tonnes, as shown in Fig 6.

Figure 6:Map of European Waste to Energy Plants 2014



Source: CEWEP[53]

[53] CEWEP, *Map of European Waste to Energy Plants* (2014) http://www.cewep.eu/information/data/studies/index.html

In comparison, NI does not have the same level of waste to energy infrastructure as Germany. Waste to energy plants in NI have struggled to win political and public backing, with a number being turned down at the planning stage. That being said, more recently NI has put forward a number of plans to increase incineration capacity e.g. the further development of a water treatment works incinerator at Duncrue Street[54] and a new waste incinerator at Bombardier In Belfast's Harbour Estate for commercial and industrial waste[55].

On the other hand, the Danish Government is promoting the move away from incineration through its *Recycle more, incinerate less* Strategy[56]

4 Conclusion

There is a long tradition of national waste strategies and waste management plans in Germany which have directly and indirectly contributed to Germany having the highest overall recycling rate (including composting) in the EU.

A ban on landfilling un-treated municipal waste, a focus on separate collection of waste including bio-waste, and long standing requirements for producer/product responsibility have been stated as important policy initiatives for high recycling rates in Germany.

That being said, Germany does not appear to be doing anything out of the ordinary. Compared to NI there are in fact a number of similar approaches and initiatives used e.g. producer responsibility and separate collection of paper, plastic, metal and glass as required under WFD requirements. However, the main difference appears to be when these policies were introduced and how they are implemented. For example, the source separation scheme in Germany takes a consistent approach in terms of the types of materials that are separated and the bins they go in.

Germany's approaches appear to have engendered positive public attitude and uptake of policies for recycling and waste to energy. Waste is very much seen as a potential resource, or source of energy, particularly through the use of waste to energy plants.

[54] NI Water https://www.niwater.com/belfast-sludge-incinerators/
[55] Planning NI http://www.planningni.gov.uk/index/news/news_releases/common_news_bombardier-energy-from-waste.htm
[56] Ministry of Environment and Food of Denmark http://eng.mst.dk/topics/waste/denmark-without-waste/