Nordic Council of Ministers

ANALYSIS OF

Nordic regulatory framework and its effect on waste prevention and recycling in the region

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Joe Papineschi, Dominic Hogg, Tanzir Chowdhury, Camilla Durrant and Alice Thomson

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Executive Summary

The Nordic region includes some of the most developed and mature waste management systems in Europe, with various aspects of the waste and resource management industry in Denmark, Norway, Sweden and Finland rightly being seen as world-leading. Although there is still much to do in the island nations to develop advanced waste management systems, the region as a whole is widely regarded as being at the forefront of tackling the key environmental, social and economic issues associated with inefficient resource use. Notable cross cutting issues for current waste management for the Nordic Nations include, to a greater or lesser extent by country, a mismatch between the current waste infrastructure and the infrastructure required to meet the recycling aspirations outlined in national waste strategies (and EU waste targets), and the challenges posed in delivering an efficient waste management system for rural populations and/or in extreme winter weather conditions.

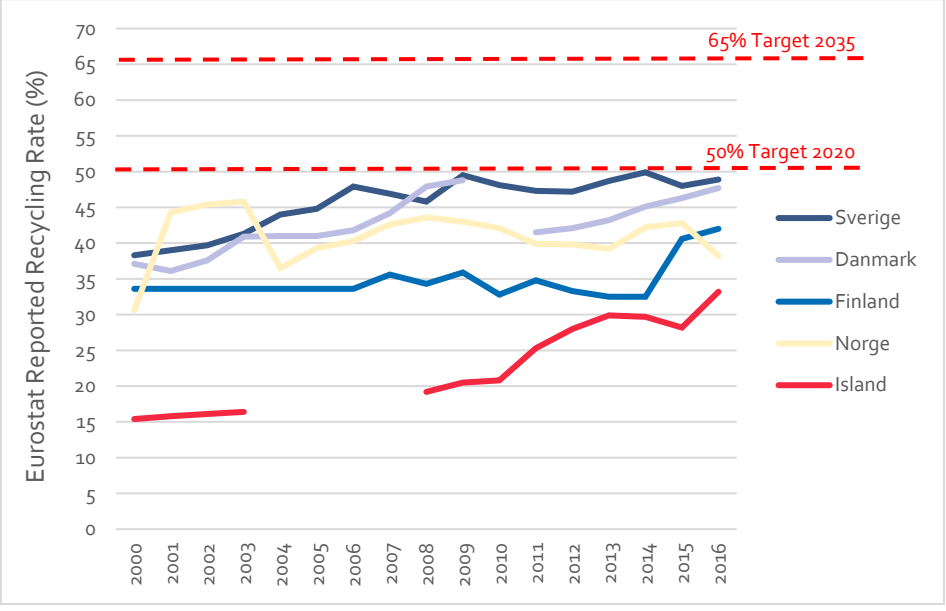
At an important time in Nordic Waste Policy, as the 2018 Circular Economy Package makes significant updates to key European Union directives, this work looks back at the Nordic regulatory framework for waste from the 1970s and its effect upon waste prevention and recycling.

To identify the policies that have had a significant impact on waste generation and recycling rates an econometric analysis was carried out for the five Nordic countries with a sufficient time series of data (Denmark, Norway, Sweden, Finland, and Iceland). The econometric model included macroeconomic variables which would be likely to affect the waste generation and recycling rates, these were: Population, Real GDP and Real household consumption. Panel data analysis was carried out in addition to an individual country analysis, the panel data overcomes issues around small numbers of data points and is more robust than the country specific analysis.

Looking at the panel data the following policies have a significant negative effect on waste generation, i.e. the presence of the policy shows a correlation with a reduction in waste generation: packaging tax and a recovery target (a target for recycling and energy recovery). For recycling rate the following policies have a significant positive effect on recycling rate, i.e. the presence of the policy shows a correlation with an

increase in recycling rate: landfill bans on both combustible waste and biodegradable waste, a deposit refund system (DRS) for metal containers and Extended Producer Responsibility (EPR). The econometric analysis shows there have clearly been a number of effective policies in the Nordic nations which have increased recycling rates and decreased arisings to the present day. However, it is also clear from the analysis of existing policies and historic performance against key indicators, set against the requirements of the revised EU waste directives, that very significant change will be required in every nation of the Nordic region to achieve the revised EU waste directives.

Figure 1: Eurostat Reported Recycling Rate of Municipal Waste for Nordic Countries Reporting to Eurostat



As shown in Figure 1, between a 16–32% increase in recycling rate is needed by 2035 (from the 2016 data) to achieve the 65% recycling rate target, even before accounting for any changes to the definition of recycling. Given that the increases in recycling rates shown for the previous 17 years in Figure 1 are in the order of ≈10–20%, the indication is that significant strategic changes are required by the Nordic countries to meet such targets.

The clearest area of required change will be a significant shift away from incineration (and in Iceland, landfilling) towards recycling. This is likely to include:

- a dramatic increase in coverage (both in terms of proportion on population covered and materials collected) of separate door-to-door collection of recyclables and biowaste;
- the introduction of more sorting capacity for mixed waste *after* separate collection has been maximised. This will help to capture more material for recycling (especially plastic) and to reduce the carbon intensity of municipal waste incineration fuels;
- the reform of policies that will help to drive this shift towards much higher rates of recycling, perhaps including:
  - increased taxes or bans on recyclable materials and biowaste entering incineration plants;
  - reform of extended producer responsibility systems, regarding municipal waste especially in respect of packaging, this will be a requirement for EU Member States as a result of the 2018 revisions to the Waste Framework Directive with minimum requirements specified.
- the development of new recycling and biowaste infrastructure; and
- behaviour change interventions for very high material capture rates to be possible. This could include use of pay-as-you-throw systems or other communications initiatives backed by economic incentives (e.g. fines and surcharges) and enforcement.

Clearly, different Nordic nations are at different points in terms of the changes necessary to their waste management systems. However, the interventions outlined above are relevant to all nations, at least to a significant degree. Fundamentally, it will be necessary for the economics of municipal waste to change across the region, such that recycling either becomes reliably the cheapest option in the long term or becomes so mandatory that the necessary investment in infrastructure and change can be made.

The consistency of issues faced across the nations is considerable and despite the many differences between them, it seems an ideal time for the region to accelerate cooperation and collaboration in this area. This collaboration could include necessary areas of development and change such as:

- analysis of policy options on EPR, market development, fiscal reform and mandatory action;
- the development of a regional approach to market development and quality standards, particularly with regard to materials that are currently exported outside the region for recycling and in respect of waste to energy incineration capacity; and
- the central provision of technical support to nations and regions in considering their options for policy and operational reform.

In the short term there is the opportunity for synergy across the Nordic Group by identifying examples of best practice for those countries performing less well at present to benefit from the experience of other countries in the group.

1. Introduction

This report provides an analysis of the regulatory framework in Nordic countries and its effect on waste prevention and recycling in the region. In addition, the report looks forward towards the revised European Union Waste Framework Directive targets and policy recommendations are made in context of these.

The report is structured as follows:

1. Introduction to Project;
2. European Union Policies;
3. Country Profiles:
    - Current & Historic Trends;
    - Approach to Collections;
    - Policies;
    - Challenges;
    - Summary of Countries.
4. Econometric Analysis;
5. Policy Recommendations.

1.1 Background and Objectives

This report falls at an important time in Nordic waste policy. For those countries which have led the way in waste management and recycling, thirty or forty years have elapsed since the formalisation of waste management and recycling systems. In a number of the Nordic countries, informal deposit systems set a precedent for valuing resources which goes back even further. However, European waste policy is at a crossroads with the 2018 circular economy package which makes significant updates to key European Union directives including the Waste Framework Directive (WFD),

Landfill Directive (LFD), and Packaging and Packaging Waste Directive (PPWD) which have contributed to the shape of Nordic legislation since their introduction. In their 2018 updates, these Directives contain higher targets across the board for recycling, they also limit the quantity of landfill permitted and put in place higher standards for recycling collections.

For the Nordic countries outside of the European Union, the changes to these directives are still valid. They recognise an increasing need to value resources, and push for a transition to a circular economy – where resource efficiency is increased, and waste generation is decoupled from economic growth. It is through this lens that we look back at the policies of the Nordic region since the 1970s (and in some cases before), looking to evaluate what has been successful and generated change, and which policies have not been effective. Through identifying examples of best practice there is opportunity for synergy across the Nordic Group, and opportunity for those countries performing less well at present to benefit from the experience of other countries in the group. Furthermore, by identifying challenges common to the group, or to subsets of countries within the group there is additional opportunity for synergy in future policy. A major objective of this work is to provide policy recommendations which maintain the ambition of the Nordic countries going forward, and continue to ensure that processes and policies are aligned with the waste hierarchy.

This report looks first at the current European Union policies in waste management, then takes a detailed look at the historic waste management and recycling policies of each of the countries – identifying potential challenges to future improvements for each. The method and results of the econometric analysis are presented, and the report concludes with a policy analysis, and a future look at incoming European policy and likely future policy.

1.2 Approach and Methodology

Eunomia worked with sub-contractors from across the Nordic group of countries to gather the information required for this work. These were Tyréns (Sweden and Norway), Affaldskontoret (Denmark, Greenland, and the Faroe Islands), Intellecon (Iceland) and SYKE (Finland and the Åland Islands). Through collaboration with these sub-contractors' information was gathered on the countries' policy journeys from 1980 (or earlier where available) to the present day. These policies, laws and regulations were

compiled alongside demographic and geographic information as well as data on waste composition (where available) to produce the country profiles in Section 3. These country profiles also include a summary view of the immediate challenges to improving performance in the country.

To contribute to understanding of effectiveness of the policies, data on waste generation and recycling was gathered for all countries where available. The aim was to gather consistent data on waste generation and treatment routes for as long a time series as possible with a view to enabling a panel data approach whereby policies could be analysed across the group as a whole. To maintain consistency, data was gathered for household waste generation as definitions of municipal waste differed between the countries. The econometric analysis was conducted on this data both for the countries as a group, and at an individual country level.

The econometric analysis and country profiles fed together into a policy analysis, which looks to pick out key areas of success and areas for improvement. In addition, Section 5.3 provides a "forward look" – analysing how the countries who are full EU Member States, or who are members of the EEA are likely to measure up against future planned or potential EU policy. This section is key for informing the recommendations proposed.

1.2.1 Limitations

It is worth noting limitations of the approach. Waste data can be unreliable, and especially when analysing data over such a long time series, is prone to artefacts in the information due to external and unrelated factors such as a change to method for data gathering or change in classification of a waste type. Where possible, these limitations have been noted in the analysis. Furthermore, for some countries waste data of this type is not gathered or has not been gathered in the past and so it has not been possible to include them in the econometric analysis. This is the case for the Faroe Islands, and Greenland. For Greenland, data was available for 2015 only. For the Faroe Islands, data was available for 2012–2016 only. Åland's data is incorporated within Finland. For Iceland, the data used is municipal waste data due to major inconsistencies across the time series in the calculation of household waste. This is elaborated on in Section 3.6.2.

Whilst we believe that the country profiles contain a good summary of the policies, laws and regulations in place, there is possibility of gaps due to the length of the time scale covered by this study, and the nature of the data gathering process. However, such gaps should not have overall impact on the messages emerging from the policy analysis, and econometric analysis as it is felt that the major impactful policies, targets and regulations have been captured.

2. European Union Policies

Of the Nordic countries, Denmark, Finland and Sweden are full members of the European Union, whilst Norway and Iceland are members of the EEA. The Åland Islands are EU members with some derogations due the islands' special status. Greenland is subject to the EU treaties through association of Overseas Countries and Territories with the EU. This was permitted by the Greenland Treaty. The Faroe Islands, a self-governing nation within the Kingdom of Denmark, are not part of the EU.

2.1 Current EU Directives

Table 1: Acronyms Used for Key Directives

EU Directive	Referred to as
The Waste Framework Directive (2008/98/EC)	The WFD
The Packaging and Packaging Waste Directive (94/62/EC)	The PPWD
The Landfill Directive (1999/31/EC)	The LFD
The Single Use Plastics Draft Directive	The draft SUPD

The relevant (parts of) EU directives for this project are listed below, these are the requirements of "current" directives and do not cover any of the additional requirements of the revised EU WFD, PPWD, or LFD. These Directives were all amended in 2018, and comment on this is made in Section 2.2.

2.1.1 *Waste prevention:*

- The WFD (2008/98/EC) contains the following provisions around the prevention of waste:[1]
  - Article 4 Puts in place the waste hierarchy, stating that it shall apply as a priority order in waste prevention and management legislation and policy, the order being: Prevention, preparing for re-use, recycling, other recovery (e.g. energy recovery), disposal;
  - Article 11 states that "Member States shall take measures, as appropriate, to promote the re-use of products and preparing for re-use activities, notably by encouraging the establishment and support of re-use and repair networks, the use of economic instruments, procurement criteria, quantitative objectives or other measures";
  - Article 29(1) requires national waste prevention programmes to be in place by 12 December 2013 which are evaluated at least every six years and revised;
  - Article 29(3) states that Member States shall determine appropriate specific qualitative or quantitative benchmarks for waste prevention measures adopted, in order to monitor and assess their progress.

2.1.2 *Recycling:*

- The target under Article 11(2)a of the WFD:
  - By 2020, the preparing for reuse and recycling of waste materials such as at least, paper, metal, plastic and glass from households and possibly from other origins as far as these waste streams are similar to waste from households, shall be increased to a minimum of overall 50% by weight;[2]
- Requirements under other Articles of the WFD:
  - Article 11(1) which states that Member States shall take measures to promote high quality recycling and, to this end, shall set up separate collections of

[1] European Parliament and the Council of the European Union (2008) Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on Waste and Repealing Certain Directives, 2008/98/EC.
[2] European Parliament and the Council of the European Union (2008) Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on Waste and Repealing Certain Directives, 2008/98/EC.

waste where technically, environmentally and economically practicable and appropriate to meet the necessary quality standards for the relevant recycling sectors. Subject to Article 10(2), by 2015 separate collection shall be set up for at least the following: paper, metal, plastic and glass.

- EPR requirements under Article 8 of the WFD:
  - Article 8 allows Member States to take legislative or non-legislative measures to ensure that any natural or legal person who professionally develops, manufactures, processes, treats, sells or imports products has extended producer responsibility;
  - These measures may include an acceptance of returned products and of the waste that remains after those products have been used, as well as subsequent management of the waste and financial responsibility for such activities.[3]
- Requirements from the PPWD (94/62/EC):
  - Article 6(1)d states that no later than 31 December 2008 between 55% as a minimum and 80% as a maximum by weight of packaging waste will be recycled;
  - Article 6(1)e gives material specific recycling rates to be achieved by December 2008. These are: 60% for glass, 60% for paper and board, 50% for metals, 22.5% for plastics (considering only material recycled back to plastic) and 15% for wood.

2.1.3 Recovery:

- The PPWD (94/62/EC) contains targets for recovery:[4]
  - Article 6(1)b requires that no later than December 2008 60% as a minimum by weight of packaging waste will be recovered or incinerated at waste incineration plants with energy recovery.

[3] Extended Producer Responsibility requirements were significantly updated in the 2018 amendments to the Waste Framework Directive.
[4] Prior to the 2018 amendments to the Packaging and Packaging Waste Directive which have repealed targets for recovery in lieu of recycling targets.

- Article (10) of the WFD refers to recovery:
  - It states that Member States should take measures to ensure that waste undergoes recovery operations in accordance with Articles 4 (The waste hierarchy) and 13 (Protection of human health and the environment).

2.1.4 Disposal:

- Targets under Article 5(2) of the LFD:[5]
  - By 16 July 2006, biodegradable municipal waste going to landfills must be reduced to 75% of the total amount (by weight) of biodegradable municipal waste produced in 1995 or the latest year before 1995 for which standardised Eurostat data is available;
  - By 16 July 2009, biodegradable municipal waste going to landfills must be reduced to 50% of the total amount (by weight) of biodegradable municipal waste produced in 1995 or the latest year before 1995 for which standardised Eurostat data is available; and
  - By 16 July 2016, biodegradable municipal waste going to landfills must be reduced to 35% of the total amount (by weight) of biodegradable municipal waste produced in 1995 or the latest year before 1995 for which standardised Eurostat data is available.
- Requirements under Article 12 of the WFD:
  - Member States shall ensure that, where recovery in accordance with Article 10(1) is not undertaken, waste undergoes safe disposal operations which meet the provisions of Article 13 on the protection of human health and the environment.
- Requirements under Article 28 of the WFD on waste management plans:
  - Article 28(1) Member States shall ensure that their competent authorities establish, in accordance with Articles 1, 4, 13 and 16, one or more waste management plans. Those plans shall, alone or in combination, cover the entire geographical territory of the Member State concerned;

[5] (1999) Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste, 182.

- Article 28(2) The waste management plans shall set out an analysis of the current waste management situation in the geographical entity concerned, as well as the measures to be taken to improve environmentally sound preparing for re-use, recycling, recovery and disposal of waste and an evaluation of how the plan will support the implementation of the objectives and provisions of this Directive;
- Article 30 requires that these plans are evaluated alongside waste prevention plans at least every 6th year and revised as appropriate.

2.1.5 Implementation of EU Policies by Nordic Countries

Table 2 shows the national policies for each of the Nordic countries which relate to the EU directives in place.

Table 2: Coverage of EU Policies

	Waste Prevention	Recycling	Recovery	Disposal
Åland	Regional Act on Waste Management (1981:3) last modified through (2014/54) – Section 3a and 3b (the waste hierarchy), and Section 4 (rules to prevent waste) Regional Decree on Waste Management (2011:74) last modified by (2013/11), Waste prevention programme of the Åland Islands (Part of the Waste Management plan) Regional Act on Environmental Protection (2008/124) last modified by (2011/73) Regional Decree on Environmental Protection (2008:130) last modified through (2011/73)	As per waste prevention legislation and the Waste Management Plan for the Åland Islands 2010	Government of Åland Decision on Rules Concerning Incineration (2003:33) Section 8a–8c of the Waste Act 1981:3 on separate collection of waste and recovery of waste where possible	Regional Decree on Landfill (2007:3) last modified by (2012/81) Prohibition to deposit bio-waste at landfills (Sector 5 – Decree on Landfill 2007:3)

	Waste Prevention	Recycling	Recovery	Disposal
Denmark	Denmark without Waste II (April 2015) The Danish Government- A Waste Prevention Strategy Section 6b of the Environmental Protection Act (Waste hierarchy) Section 12 of the Waste order (Waste hierarchy)	2013–2017 Resource Strategy ("A Denmark Without Waste"), and the Danish Resource Plan (May 2014) contain targets for recycling	Denmark's Waste Order	Denmark's Waste Order, Ban on landfill of waste suitable for incineration (1997) Sections 15 and 22 of the Landfill Order which allow landfill of certain waste types only[6] Landfill Taxes (1987)
Finland	Waste Act 646/2011 (Section 8 – the Waste hierarchy, and Section 11) Government Decree on Waste 179/2012 Environmental Protection Act 527/2014 Environmental Protection Decree 713/2014 Finland's National Waste Plan ("From recycling to a circular economy" – plan to 2023) – contains a waste prevention programme and aims	Relevant sections of legislation listed against waste prevention, and the: Government Decree 528/2013 on the Collection and Recycling of Waste Paper Government Decree 518/2014 on Packaging and Packaging Wastes Government Decree 526/2013 on the Beverage Packaging Return Scheme	Waste Act 646/2011 – Sections 8 and 13 on obeying the waste hierarchy and on treatment in a controlled manner Government Decree on Waste 179/2012 Environmental Protection Act 527/2014 Environmental Protection Decree 713/2014	Section 13 of the Waste Act (646/2011) on disposal of waste Section 27 and Annex 1 of the Environmental Protection Act (527/2014) Finland's Landfill Tax (Waste Tax Act 1126/2010) Government decree on landfills 331/2013 – prohibiting landfill of organic waste
Iceland	Waste Prevention Programme (2016–2027) "United against waste"	National Plan on Waste Handling		
Faroe Islands	No legislation to this effect			
Greenland	Greenland's legislation is not consistent with EU Directives. The major policies for waste management are the Waste Action Plan (2010), and the Plan for the Waste Sector (2015)			

[6] https://www.retsinformation.dk/forms/R0710.aspx?id=137791#K5

	Waste Prevention	Recycling	Recovery	Disposal
Norway	Waste Prevention programme (2013)	Waste Regulations (2004)	Waste Regulations (2004) – Chapter 10 on the incineration of waste	Waste Regulations (2004) – Chapter 9, Landfill bans for waste types (includes landfill ban on biodegradable waste – introduced 2009)
Sweden	The environmental code (1998:808), amended 2018:1427 (Chapter 1, Section 1; Chapter 15–5a, 10, 11, 19 and 20) – contains provisions on the waste hierarchy The Ordinance on waste (Section 14, 15, 74, 81–83) Sweden's Waste Prevention Program (2014–2017)	The Ordinance on waste (2011:927), amended (2018: 1466) Sweden's National Waste Plan (2012–2017)	Ordinance on the incineration of waste – Section 21 (2013:253) Requirements for sorting of combustible waste promoting energy recovery – Ordinance on waste (Section 14, 15)	Ordinance on the landfill of waste (2001:512) Landfill tax (2001) Landfill ban on combustible waste (2002) Landfill ban on organic waste (2005) SEPA Regulations on the landfill of waste, criterias and procedures for the acceptance of waste at facilities for landfill of waste (2004:10)

2.2 Waste Framework Directive / Circular Economy Package

The Directive (EU) 2018/851 Amending Directive 2008/98/EC on Waste (the WFD) commenced on 4 July 2018, after the project had initiated and it was agreed with the Nordic Waste Group that the regulations within this should be given due consideration.

Notably the definition of recycling specifically includes the following:

- business waste that is similar to household;
- organic fraction of street sweepings;
- litter bins; and
- metals recovered from incineration.

The following are specifically excluded from the definition of recycling:

- compost Like Outputs (CLO) from 2027 (by specifying bio-waste must be separately collected or separated at source);
- inert street sweepings (sand, rock, mud or dust);
- construction & Demolition (C&D) Waste, including DIY waste and rubble. Also interpreted to mean wood is excluded; and
- incinerator Bottom Ash (IBA).

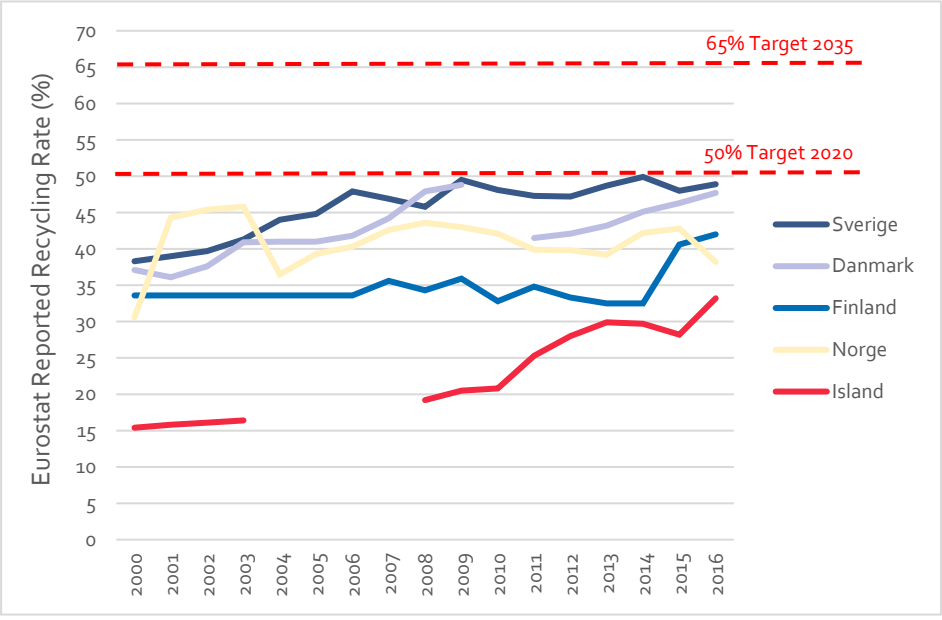
Other updates of note for this project include the following:

- clarifies the point of measurement for recycling is weight of municipal waste that enters recycling;
- specifies separate collections of paper, metal, plastic, glass, bio-waste, hazardous waste produced by households and textile waste;
- members states must establish specific food waste prevention measures;
- the extended producer responsibility sections of the directive have been expanded;
- specific reference to pay as you throw schemes.

The updated targets, which are perhaps the most of interest for this project, are as follows:

- by 2025, the preparing for re-use and the recycling of municipal waste shall be increased to a minimum of 55% by weight;
- by 2030, the preparing for re-use and the recycling of municipal waste shall be increased to a minimum of 60% by weight;
- by 2035, the preparing for re-use and the recycling of municipal waste shall be increased to a minimum of 65% by weight.

Figure 2: Eurostat Reported Recycling Rate for Nordic Countries



At present, none of the Nordic countries are reaching the ultimate 2035 target (and across the EU very few countries are at this level). Utilising data reported by several Nordic countries in Eurostat from 2016, between a 16–32% increase in recycling rate is needed by 2035 (from the 2016 data), even before accounting for any changes to definition. Given that the increase of recycling rates shown for the previous 17 years in Figure 2 are in the order of 8–18%, the indication is that significant strategic changes are required by the Nordic countries to meet such targets.

Before the new Circular Economy Package member states were able to choose from four measurement methods (Table 3).

Table 3: Overview of Nordic Member States Calculation Methods and Recycling Rates

Member State	Calculation Method	2010	2011	2012	2013	2014	2015
Denmark	Method 1	-	-	51.70%	51.90%	52.70%	-
Finland	Method 4	32.60%	34.80%	33.30%	32.50%	32.60%	-
Sweden	Method 2	62.00%	-	62.20%	-	61.40%	61.40%

Source: Information made available by the European Commission and includes data supplied to Eurostat and submitted as part of Member State Waste Framework Directive Implementation Reports.

The new Circular Economy Package now specifies a single measurement method against which all recycling rates should be calculated. This method is most similar to method 4, although it is significantly more stringent in measuring recycling at the point of entry into the physical recycling process. Therefore, the reported recycling rates for all countries reporting to EU are likely to change, most notably Denmark and Sweden who utilise Method 1 and 2 respectively at present. Further consideration of how each of the Nordic countries are performing against the regulations are discussed in 5.3.

3. Country Profiles

This section provides detail on the waste management in each Nordic country covered, including detail on past and current performance, policies and challenges. Waste data, where available, is also presented for each country and clearly labelled as to which the waste streams covered, since it was not always possible to obtain data which aligned with the municipal waste definition outlined within the WFD. In many cases this covers just household waste. The approach to these sections relies upon the use of country experts and as a strategic piece of work aims to give an overview of the key policies rather than being entirely comprehensive, therefore any errors or omissions should not detract from the overall methodology and conclusions drawn.

3.1 Åland

The Åland Islands ("Åland") are an autonomous region of Finland and are the smallest region of Finland, with a population of around 29,500[7] occupying 0.5% of the land area. Around 90% of the population reside on Fasta Åland ("mainland"), however there are around 6,700 islands in total, of which around 60 are inhabited.[8] Åland is located close to mainland Finland, around 100 km from the Finnish coast, in the entry of the Gulf of Bothnia. There are ferry connections between Åland and both Finland and Sweden.

[7] ÅSUB 2017 https://www.asub.ax/en/statistics/population/size-and-structure-population

[8] http://www.legco.gov.hk/research-publications/english/1314fsc43-autonomy-of-the-aland-islands-20140902-e.pdf

3.1.1 *Current and Historic Trends*

The majority of waste data for Åland is reported within the Finland statistics and therefore for this analysis there was no time series of separate waste data publicly available. Statistics and Research Åland (ÅSUB) have reported total household and similar waste since 2010 but there is no breakdown on the amount of different waste streams within the household waste category and the proportion which is recycled. Åland does, however, set some of their own targets.

Table 4: Household waste arisings report by ÅSUB compared to Dwellings and Population

Year	2010	2012	2014	2016	Change
Waste arisings	6,563.6	6,308.8	6,865.9	8,794.0	25%
Dwellings	14,957.0	15,400.0	15,864.0	16,125.0	7%
Population	28,007.0	28,502.0	28,916.0	29,214.0	4%

Some data have been collected in the past on the waste composition in Åland. Analysis completed in 2015 demonstrated that 21–23% of waste generated was organic waste, whilst this is generally considered to be a relatively low figure compared to other Nordic countries there is clearly further potential for separation and recycling of organic waste. Looking solely at household waste, Åland's recycling rate in 2014 was reported at ~51%,[10] although the exact measurement method is not clear, it is noted this is relatively high for the Nordic countries, particularly compared to Finland, where policies are similar. The main materials contributing to this high recycling rate are (in order): paper and cardboard (household and businesses), food waste (household and business), metal (households), wood waste and glass (households and businesses).[9]

3.1.2 *Approach to Waste Collections*

All households are covered by waste collection. There is a single municipal waste service, Åland Miljöservice (MISE), which manages municipal waste collections (excluding municipal waste from private sector) on behalf of six of the municipalities in Åland. The inhabitants in these municipalities account for around 63% of the population

[9] COWI (2017) Waste Management in Small Communities - Suggestions for Improvement, 2017.

of Åland.[10] MISE use both a 4 compartment multi-locker system and an 8 compartment system for waste collections. MISE and the remaining ten municipalities are each responsible for collection and handling of household waste in their catchment area. In some municipalities, this relies on a bring scheme whereby residents deliver 7–8 fractions of waste/recyclables to a focal station. These fractions are: paper, cardboard, TetraPak, hard plastic, glass, metal and in some places organic waste. Residual waste is also collected.

All households on the main Fasta Åland have the option of household collection, which is provided in a number of options, covering a varying number of fractions. The waste collection is charged, with residents paying a fee which covers the costs for transportation and disposal. The grounds for determining the waste charge are the type of waste stream, the quality of the waste, the quantity of waste and number of pickups.

The recyclable materials, with the exclusion of organic waste, various hazardous and combustible waste, are shipped to Finland or Sweden for further processing or disposal. Plastics are collected but not recycled due to lack of facilities in Åland.

The definition of municipal waste for the Åland is:

> Waste that comes from private households, or waste that is from trade, industry, institutions or other sources and is similar in quality and quantity to the waste from private households.

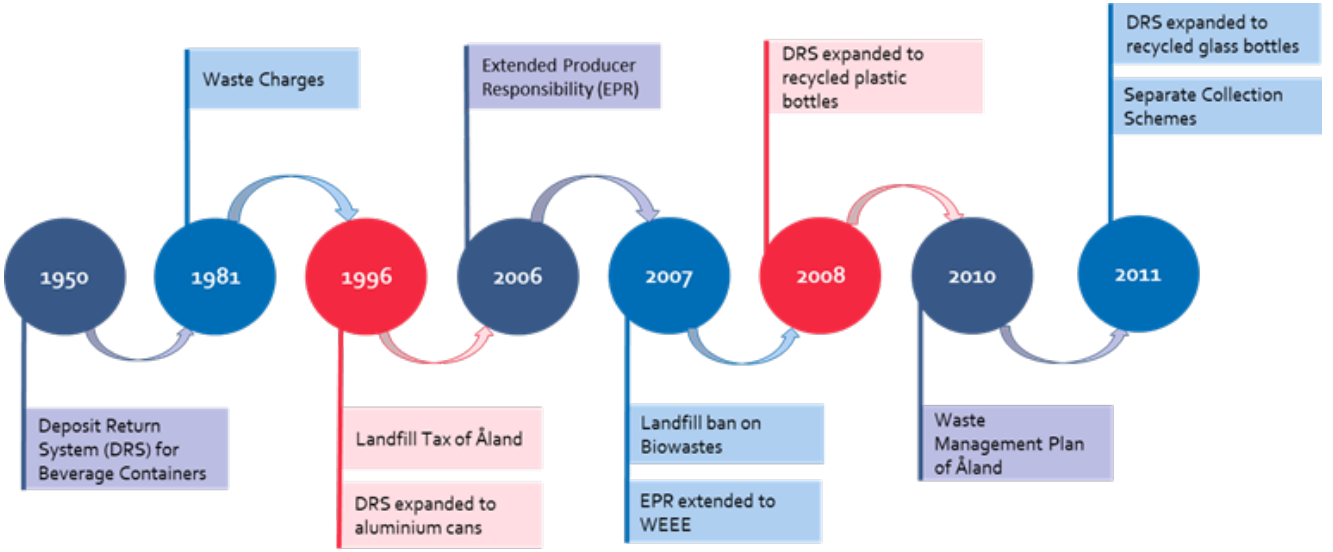
This definition is broadly comparable with the WFD definition.

3.1.3 Policies

There are a number of policies in place related to waste that broadly mirror the Finnish policies. Additionally, Åland have their own waste management plan. An overview of waste policy in Åland is shown in Figure 3.

[10] COWI (2017) Waste Management in Small Communities - Suggestions for Improvement, 2017.

Figure 3: Waste policy timeline for Åland



Note: Policies for DRS distinguish between the fate of material, where "recycled" is specified the material is recycled upon collection through DRS rather than being washed for re-use. The DRS system started with glass bottles for re-use (washed and re-filled).

Deposit System for Beverage Containers (1950)

The deposit system in Åland is the same as the system in mainland Finland and has been in place since 1950 for glass bottles for re-use, expanding to aluminium cans in 1996, plastic bottles in 2008 and recycled glass bottles (rather than re-used) in 2011. However, it is governed by authorities from Åland instead of Finnish authorities. (See 3.4.5 for details of Finnish system).

Waste Charges (1981)

In 1981, charges for municipal waste were introduced to cover the costs of municipal waste management. Under this policy, municipalities are able to set a fee which is paid by residents for collection and disposal of waste. The level of fee charged can be reviewed annually or otherwise. The aim of the fee is to cover the costs for the transport and disposal of municipal waste and is amalgamated into a single waste charge. There have been minor changes but the evolution of the policy has been similar to that of the Finnish waste charge system.

Landfill Tax of Åland (1996)

Landfill tax was introduced in Åland in 1996 and is levied on all waste deposited at landfill sites, provided that:

- its utilisation is technically feasible and environmentally justifiable; and
- that by imposing the tax, waste can be made more commercially exploitable.

Waste categories with no technical treatment or utilisation alternative to disposal at landfills, or with utilisation options that would do more harm than good, are tax exempt. Such categories include mineral waste and waste from inorganic chemical processes. Another category exempt from the tax is hazardous waste deposited at landfills. Waste used in the structure of landfills, in a manner that the permit or supervisory authority deems acceptable, is also tax exempt.

All landfills where waste falling into a taxable waste category is deposited are subject to the waste tax. This covers both public and private landfills, as well as all waste disposal areas. In keeping with the previous Waste Tax Act, storage of waste lasting less than three years, waste composting or utilisation areas and dumping areas are exempt from the waste tax. The tax rate has changed significantly over time, increasing from

EUR 15.14/t in 1996 to EUR 70/t in 2017. From 2007, biodegradable waste has been banned from landfills[11] – this effectively means a ban on all mixed wastes, since these contain biodegradable wastes. The primary effect of this regulation has been a switch in residual waste treatments.

Extended Producer Responsibility (2006)

In 2006, Åland introduced producer responsibility for end-of-life vehicles (ELVs), packaging and packaging waste, batteries and accumulators and electronic and electric equipment.

Producer responsibility in WEEE on Åland is managed through producer organisations, Elker, Serty and ERP are approved and active on Åland. Elker Ltd is a service company owned by three producer organisations: the SELT association, ICT producer cooperative and FLIP association. These producer organisations are registered in Åland, and as such their member companies need not separately apply for registration in the producer register of Åland's supervising authority.

Elker Ltd requests all members of the producer organisations that supply products to Åland's market notify them.

Extended Producer Responsibility for Waste Electrical and Electronic Equipment (2007)

Producer responsibility for Waste Electrical and Electronic Equipment (WEEE) started in Åland on 1 January 2007 and since then, five reception points of WEEE have been opened.

Producer liability entered into force in Åland on 1 January 2007. From this date, the products exported to Åland must be reported to the producer organisation, and recycling fees are to be paid for the products. Products exported to Åland are subject to quarterly product reports to facilitate accurate record keeping and to ensure responsibility is taken.

Waste Management Plan of Åland, Avfallsplan (2010)

The Waste Management Plan 2010 ("The Plan") of the Åland Islands aims to encourage efficient use of resources and recovery and use of waste, whilst minimising the impact of waste management on health and the environment. As such, The Plan looks to reduce the total amount of waste generated, use the waste generated as a resource

[11] With the exception of dead wild animals, pets and animal by-products, according to Sector 5 Decree on Landfill, 2007:3.

where possible, encourage clean material cycles and work on increasing the safety of waste handling.

The Plan encourages composting food-waste and other biowaste at home in rural areas where this is possible, and transport of the biowaste to a composting plant where this is not possible. Separate collection of biowaste should increase, and the Decree on Waste[12] provides the legislative background for developing collection systems. The Plan stresses that anaerobic digestion is a more environmentally attractive option to composting, and would preferentially treat biowastes with AD rather than composting.

The waste prevention program of Åland, a part of The Plan, proposes an area at every municipal collection site to be reserved for things that can be re-used. The Plan also describes the important work non-profit organizations and private companies do to prepare products for re-use.

The Plan also sets quantitative targets for waste management. It sets a target of 60% recycling for waste, 30% recovery and a cap of 10% of waste sent to landfill by the year 2020 against 2010, when the plan was written. These targets replace those in the 1999 Waste Management Plan for Åland and are set at a more ambitious level.

To achieve these targets, the following measures are suggested in the plan:

- Environmental requirements for public procurement;
  - informing consumers about sustainable consumption to reduce the amount of waste, and amount of hazardous waste;
  - informing consumers about long-term risks and effects of diffuse emissions of hazardous substances in order to prevent, for example, the private burning of trash;
  - that regulations are issued for sorting waste at construction sites;
  - investigate material recycling for mixed plastic packaging;
  - energy production is promoted through digestion of food waste and other waste.
- Of the proposed measures, which are specific to Åland, the following are the most important:

[12] Section 7 of the Decree of Waste 2011:74.

- to highlight to municipalities that municipal cooperation provides the best option for handling issues related to waste, developing improved waste management and reducing costs from joint procurement of waste services;
- to seek a low base fee for waste collection and sanitation to gain public acceptance of charges. Taxing collection of waste area where required to lead to increased reuse and recycling of household waste. Waste fees are built to encourage sorting;[13]
- collection of households' flammable waste takes place through household collection in urban areas, but also in rural areas if collection lines can be established without great additional costs;
- waste in the archipelago is collected mainly at common points ("bring banks").

Separate Collection Schemes (2011)

The separate collection scheme developed in Åland aims for better waste management and enabling waste to be used as a resource. According to the Decree on Waste,[14] separate collection should be organized for paper, metal, glass and biological waste. Companies producing construction and demolition waste must separate concrete, brick, mineral tile and ceramic waste, gypsum-based waste, non-impregnated wood waste, metal waste, soil and waste rock material according to Sector 11 in the same Decree.

As a result of this policy, the Åland Islands have separate waste collection for all fractions that are possible to recycle, and for hazardous waste. Plastic is not recycled due to a lack of facilities[15], but is collected separately and recovered as energy.

[13] For example as by Mise http://www.mise.ax/component/docman/cat_view/3-serviceval-och-avgifter?Itemid=63

[14] Sector 7 and 8 in the Decree on Waste 2011:74.

[15] Material recycling for plastic is something which the Åland Islands state that they are looking into under the 2010 Waste Management plan.

3.1.4 Challenges

Åland has one of the highest reported recycling rates in the region. Whilst the calculation method for the 51% recycling rate is not clear, one reason for a better performance could be the relatively small travel distances, as most inhabitants live on the main island. In mainland Finland, longer travel distances can lead to reduced coverage of comprehensive collection systems as these can be relatively expensive to provide.

Clearly there is an additional geographic challenge for Åland compared to mainland Nordic countries to transport waste from the islands to Finland, Sweden and beyond for treatment and reprocessing. However, compared to some of the other countries or autonomous regions assessed in this work, the transport distances are small and the island currently exports most dry recyclables successfully, with the notable exception of plastics which are currently sent for incineration. Åland already have food waste treatment facilities on the island but the composition analyses indicate further potential for the separation and treatment of food waste. The food waste is currently treated via composting but there are additional environmental benefits that could be gained by switching to anaerobic digestion, as is noted in The Plan.[16]

3.2 Denmark

Denmark is by far the most densely populated Nordic country, and with a population of 5.6 million, it is the second most populous of the Nordic Countries after Sweden. Population density for Denmark is much greater than any other Nordic country at 136/km^2. Copenhagen is the largest metropolitan region of any Nordic City with a population of 1.8 million in the Capital Region of Denmark.[17]

[16] Waste Management Plan of Åland, Avfallsplan (2010).

[17] Danmarks Statistik http://www.statistikbanken.dk/statbank5a/SelectVarVal/saveselections.asp

3.2.1 *Current and Historic trends*

Denmark's definition of municipal waste has been the same since 1987. It is defined as:

> "Waste from households except construction waste and including commercial waste that is collected in municipal schemes, which includes:
>
> Commercial waste in collections scheme for residual waste from households (app. 5–20%[18]);
>
> and, Commercial waste received on municipal recycling stations (app. 5%[19])"

All waste from households is collected in Denmark. The only exception to this is a small amount of garden waste which is home composted: the majority of garden waste is delivered to central recycling facilities for composting, a part of this garden waste is being sent to energy recovery. At present, preparation for reuse is not registered in Denmark, but will be in the future.

The existing point of measurement is at the point where material is collected for recycling, and so it is likely that the recycling rate is overstated compared to the EU Waste Framework Directive definition, where the point of measurement is the point where municipal waste enters the recycling operation.

There is no detailed information on the amount of recycling from the deposit return system included in the earlier statistics. In more recent years, recycled one-way packaging from households in the deposit system are registered as household waste in the total amount. The total amount of recycled glass, plastic and metal in this system in 2015 was 45,000 tonnes, which works out at 8 kg per inhabitant.

The Danish Environmental Protection Agency (EPA) changed the waste data system between 2009 and 2010 going from the Information System for Waste and Recycling (ISAG) system to Affaldsdatasystemet (ADS). This resulted in a lack of data in 2010 and some differences between the data from ISAG up to 2009 and from ADS from 2011 onwards. There are still uncertainties in the new data system (ADS). Some of these uncertainties come from the fact that data is reported by all companies that transport or receive waste which may not all report correctly against the correct definitions.

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[18] It is estimated 5–20% of residual waste in collection schemes in commercial. The EPA estimates 15% (page 23 in waste statistics 2016). Municipalities are not allowed to collect recyclable waste from commercial activity – except from the recycling stations.

[19] There is no statistics on amount of commercial waste received at recycling stations, EPA statistics report consider the amounts of commercial waste received at recycling stations so small it is counted within the total amounts as household waste.

Figure 4: Household Waste Arisings report in Danish Waste Statistics in Denmark by Treatment Route and Recycling Rate

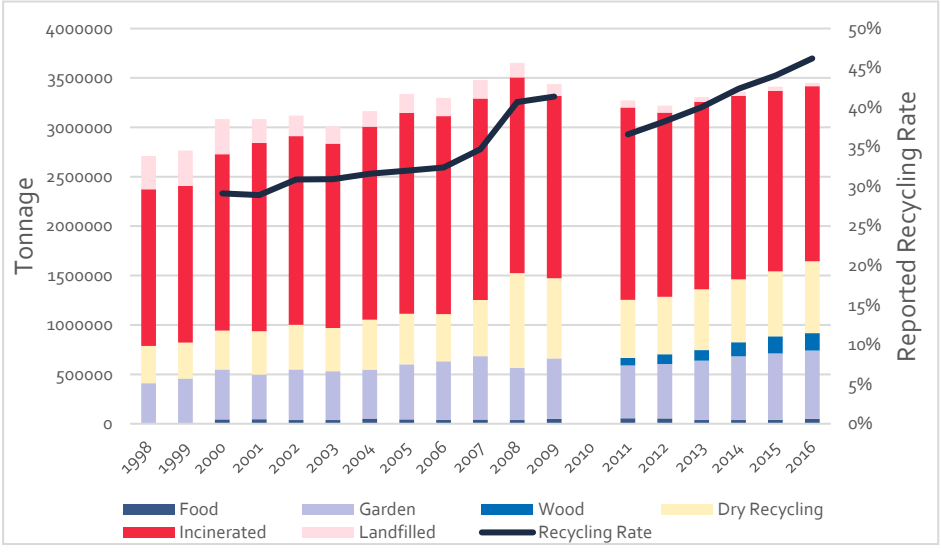
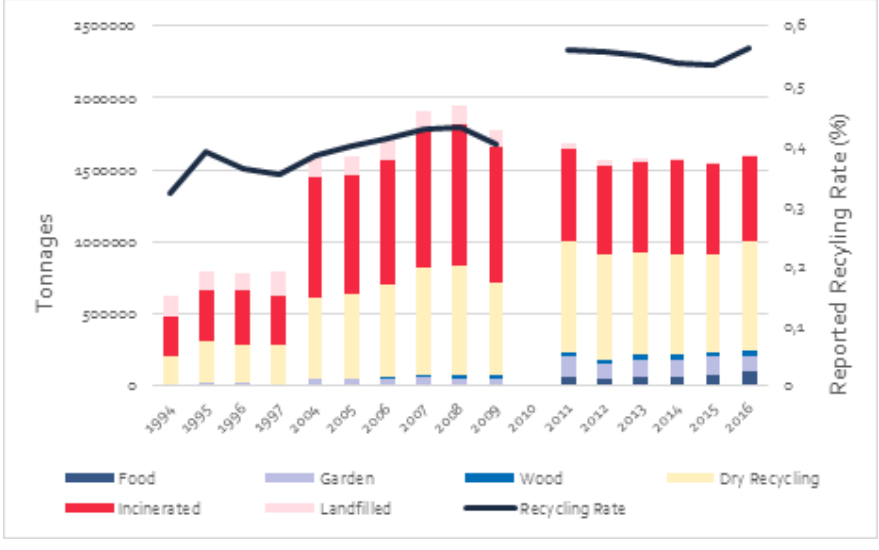


Figure 5: "Similar to Household" Waste Arisings in Denmark by Treatment Route and Recycling Rate*



Note: *A change in the data system between 2009 and 2011 is thought to be responsible for the marked change in the reported recycling rate and tonnage of waste generated.

3.2.2 *Approach to Waste Collections*

Waste collections have been provided in towns in Denmark for over 100 years. These were originally voluntary but responsibilities were later (≈50 years ago) translated into regulations. Municipalities have been obligated to collect refuse from households for more than 40 years in towns, and all householders are obligated to deliver refuse to the collection point and pay for it with a fee. This fee is collected by the municipalities and the regulations describe how it should be used. From 2010 onwards, fees have to be calculated for each collection scheme, and the fee from one scheme cannot be used for other collection schemes. This means that there are limited possibilities to use fees as economic incentives, as fees cannot be used as a monetary tool to make collection of refuse more expensive and collection of recyclables cheaper.

Most municipalities have a fee for refuse based on the volume of the container, with the option of different container sizes, and another fee per household which covers the cost of recycling schemes. This allows households to save money by reducing the quantity of refuse produced by using a smaller container and creates an incentive for reducing waste generation. However, as the cost differential is small it is not that effective as a tool.

A small number of municipalities have a weight-based fee on refuse (estimated 2–3% in 2018), as a result of the complicated technology and administration required to enforce this. All municipalities have free access to recycling stations for households that pay a general fee per year, regardless of how much they use the recycling station. There has also been limited use of differential frequencies, due to the expense of running different frequencies. In some municipalities where residual and food waste is collected fortnightly, households can pay extra to have weekly collections.

In the past 2–4 years, the introduction of food waste collections from households, collected alongside refuse, means that waste is collected fortnightly rather than weekly to reduce costs and finance new collection schemes for recycling. Information about the schemes are provided but there are no formal mechanisms to encourage recycling, for example there is no economic incentives or enforcement. Some municipalities give households the option to choose weekly collection of food waste in the summer months.

In 1986, a mandatory collection of newspapers, magazines and glass packaging for recycling was introduced for households in settlements with more than 2,000 households, usually implemented through the provision of bring banks. The limit was later reduced to cover all settlements of more than 1,000 households and a later implementation in 2003 also enforced municipalities to change from street level banks

to door-to-door collection, if the collection scheme does not accomplish 55% collection of the potential paper amounts from households.

The overall service coverage of door to door collection is shown in Table 5, where paper is the most widely collected recyclable whilst glass and food waste are only being collected from 37% of households.

Table 5: Service coverage in Denmark 2017

	Number of municipalities	Number of households	Coverage of households
Food waste	36*	975,704	37%
Paper	73	2,146,448	81%
Cardboard	36	1,303,474	49%
Glass	38	995,383	37%
Metals	47	1,580,625	59%
Plastic	41	1,458,045	55%
Total in Denmark	98	2,662,595	100%

Note: *With the additon of 6 extra which began collection in 2017 (not within data).

The current composition of household waste in Denmark is shown in Figure 6 and indicates 77–78% is readily recyclable with current technology, if all households were able to sort all recyclable waste. Figure 7 shows the current composition of residual waste, again indicating the presence of readily recyclable materials which are not being captured with the current system. It must be noted that the composition is based on no recycling of organic waste and plastics, while some of this is currently collected in some municipalities. Additionally, any materials collected at recycling stations (wood, WEEE etc.) are not shown within the composition.

Figure 6: Household Waste Composition (excl. Bulky Waste) in 2017

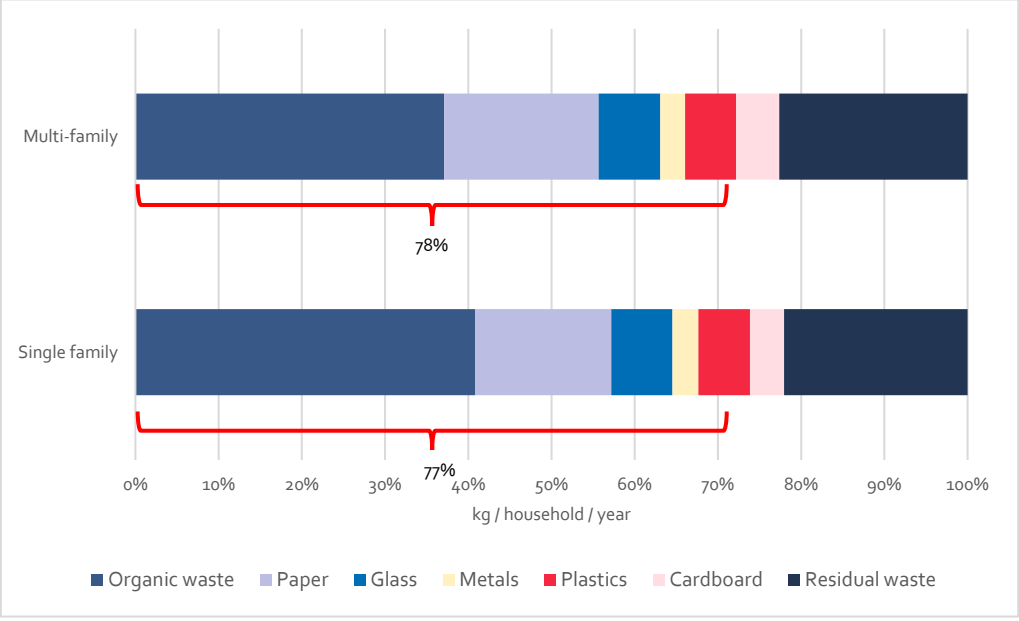
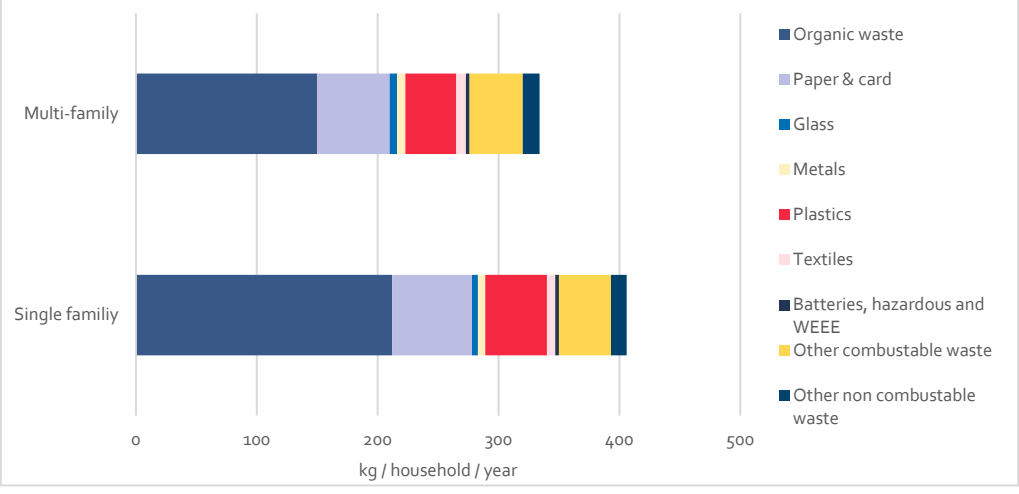


Figure 7: Residual Waste Composition*



Note: *https://www2.mst.dk/Udgiv/publikationer/2018/03/978-87-93614-78-9.pdf

3.2.3 *Policies*

The Policies relevant to Waste in Denmark are shown in Figure 8 and Figure 9.

Figure 8: Timeline of Danish waste policy 1942–1994

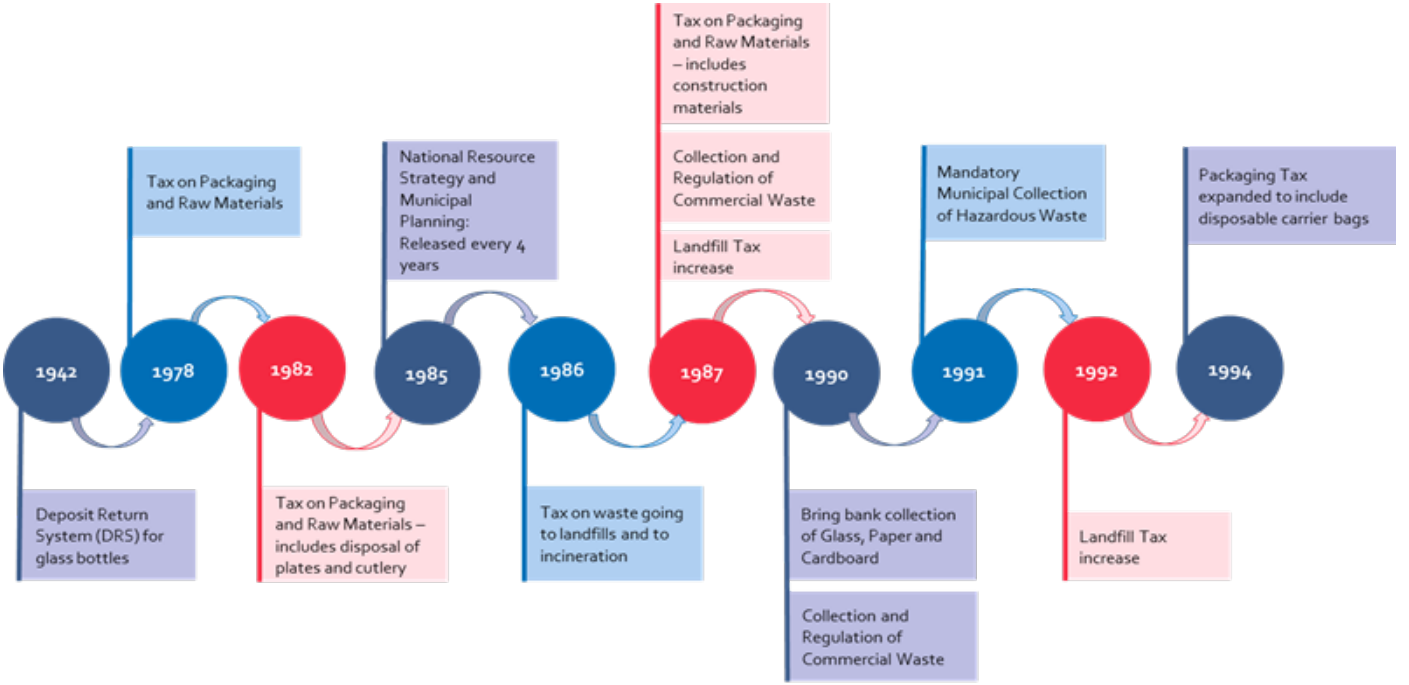
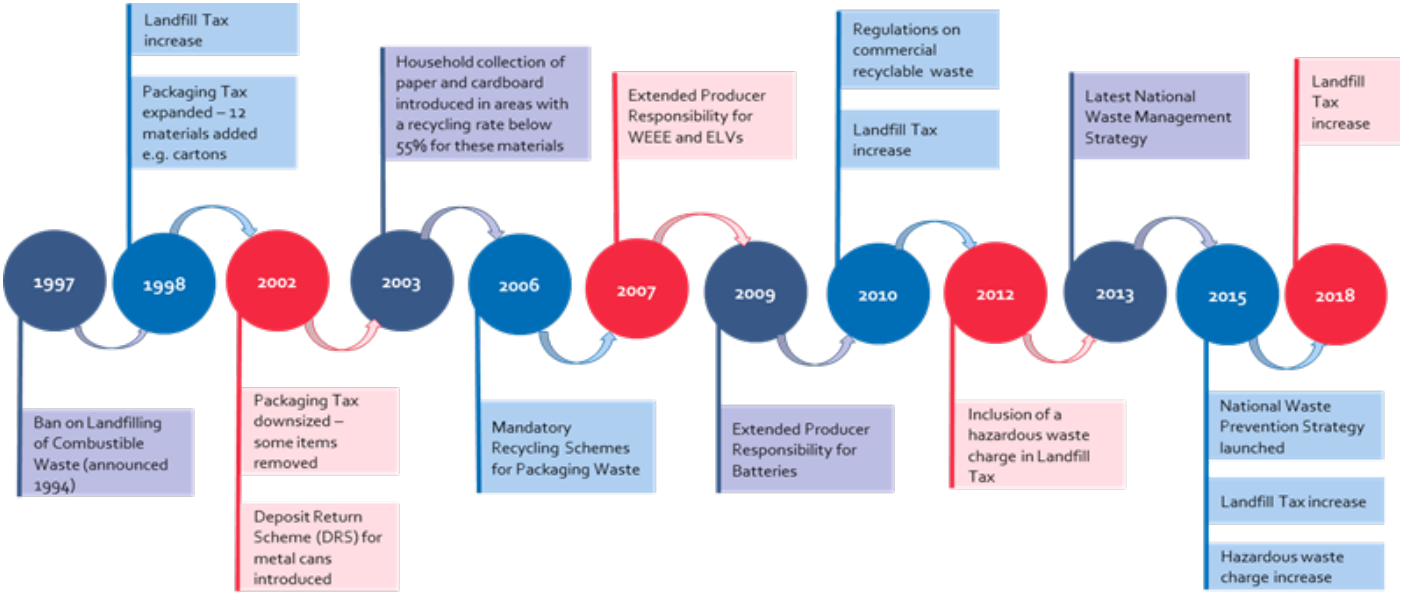


Figure 9: Timeline of Danish waste policy 1997–2018



Deposit Return System for Beverage Containers (1942)

In 1942, bottle deposits were launched in Denmark, covering glass bottles and brought about by the brewery organisations. From 1991, the deposit system also covered plastic bottles, and from 2002 onwards metal cans were also included. Dansk Retursystem was established by the breweries organisation in Denmark in 2000 as a non-profit organisation to manage the new deposit system, established in regulation in 2002.

The system now covers all beverage containers of beer, soft drinks and water (not juice) less than 20 litres in capacity. The system is divided into:

- refillable bottles which the breweries themselves collect and refill; and
- disposable packaging, which is collected by Dansk Retursystem to sort and sell for recycling.

The regulation is based on a common agreement with beverage producers and retailers, and defines:

- which beverages and packaging producers must place a deposit mark on;
- who has to accept the empty bottles and cans returned by consumers; and
- how Dansk Retursystem has to manage the system.

All enterprises or individuals that sell or supply beverages on which deposits are payable are legally obligated to take back the packaging and refund the deposits paid.

Dansk Retursystem has exclusive rights to operate the deposit system and collect disposable packaging from the enterprises for recycling. The deposit ranges from 1–3 DKK/piece (EUR 0.13 for a 350 ml bottle or can). Deposit levels were reduced in 2004 by around a third with the level today[20] for a 350 ml glass bottle or can is EUR 0,13 and plastic bottle at EUR 0.20.

The aim of the modern deposit system in Denmark is to increase recycling and reuse of beverage packaging based on the business sector's own system. Collection of separated material in this way allows the quality of recyclate to remain high so that

[20] https://www.danskretursystem.dk/alt-om-pant/pris-paa-pant/

some packaging can be reused and other packaging can be sold to recyclers for new quality products.

Collection of materials in the most recent year reported stood at 1.1 billion units for bottles and cans collected for recycling, and nearly 45,000 tonnes of glass.

The Government have announced to extend the system to cover juice packaging in 2020.[21]

Tax on Packaging and Raw Materials (1978)

A tax on packaging and raw materials was initially introduced in 1978. The tax was based on volume and covered only beverage packaging: glass, metals, plastics and cartons. Since its introduction, the legislation has been updated a number of times to include a greater range of items. However, in the early 2000s the tax was refined to remove some items over concerns about the competitiveness of Danish products affected by the taxes. The list of updates made is as follows:

- Updated 1982 – includes disposable plates and cutlery;
- Updated 1987 – Includes materials for construction;
- Updated 1994 – Includes disposable carrier bags;
- Updated 1998 – Includes twelve additional materials – cartons, plastics, metals;
- Updated 2000 – Tax on PVC foils for food introduced;
- 2001 – Revised so that the tax is now based on LCA; and
- 2002 – Updated to remove some items from the tax on packaging and raw materials.

The present list of materials covered by the tax is shown in Table 6. The aim of the tax is to reduce the quantity of raw materials used in production. As taxes are only imposed when producing or importing, there is no tax when refilling beverage containers. If containers are exported for refilling the tax can be refunded.

[21] https://mfvm.dk/nyheder/nyhed/nyhed/der-kommer-pant-paa-juice-og-saftflasker/

Table 6: Materials Covered and Tax Level (DKK and EUR)

Material	Tax Level
Beverage Packaging not covered by Deposit System (Glass, Metals, Plastics, Cartons)	DKK 0.08 to 1.6 (EUR 0.01 to 0.21) per piece
Beverage Packaging covered by Deposit System	DKK 0.05 to 0.64 (EUR 0.007 to 0.086) per piece
Disposable Carrier Bags	10 DKK/kg (0.13 EUR/kg) for paper bags, 22 DKK/kg (2.95 EUR/kg) for plastic bags
Disposable Plates and Cutlery	19.20 DKK/kg (2.6 EUR/kg)
PVC Foils for Food	20.35 DKK/kg (2.7 EUR/kg)
Raw Materials	5 DKK/m^3 (0.7 EUR/m^3)

National Resource Strategy and Municipal Planning (1985, Latest Plans 2013 and 2015)

The latest national strategy aims to increase recycling and reduce incineration, reduce overall waste quantities, increase resource efficiency and reduce the environmental impact from waste in Denmark. The national strategy sets the overarching framework and, within this, municipal plans are made.

The national resource strategy addresses all types of waste, but since 2010 the municipal plans cover only household waste, commercial waste for incineration and landfilling and commercial waste received at municipal recycling stations.

The first waste management planning system was initiated in 1985. The latest national strategy for waste management was launched in 2013, and for waste prevention in 2015. Municipal waste management plans covered four year periods in the past and now cover six year periods, with the existing municipal waste management plans for 2012–2018.

The national strategy is not mandatory for municipalities but has had a major impact on municipal collection of household waste as it includes a target for 50% recycling in 2022, with focus on seven waste types: organic waste, paper, cardboard, glass, metals, plastics and wood. Recycling of garden waste and other waste types are not part of the calculation, meaning that the target is more difficult to reach. Recycling

calculated this way was 36% in Denmark, while recycling of all household waste was 48%, and reported recycling to EU was 56% in 2015.[22]

The waste prevention strategy includes two horizontal themes: resource efficient companies and green consumption, and five focus areas: reducing food waste, construction, textiles, electronics and packaging. It is difficult to estimate the effect of the strategy. Many initiatives for reducing food waste have been implemented following the strategy, and the latest statistics of waste showed a minor reduction for food waste from households from 261,000 in 2014 to 247,000 tonnes in 2016.[23]

The national strategy has been supported by the Danish EPA and funded to the level of DKK 200 mn over the period of 2013–2017. This funding has been used to support pilot schemes trialling various measures in municipalities. The EPA expect the 50% target to be reached in 2022. Most municipalities have implemented household collections of organic waste and/or dry recyclables (paper, cardboard, metal, glass and plastics). Focus on recycling of wood received at recycling stations has also been increased.

In regards to waste prevention, national partnerships have been established with representatives from all parts of the value chain for food, textiles and construction. National support has also been given for campaigns, technology development and investigations to support waste reduction.

Danish Waste Tax on Landfills and Incineration (1986/1987)

The Danish Waste Tax on Landfills and Incineration was announced in 1986 and was introduced in January 1987 for municipal waste sent to landfill. It was updated in 1990 to cover all waste. It covered the following wastes:

- all waste entering landfill sites;
- all waste entering incineration plants;
- sewage sludge; and
- other sludges.

[22] https://www2.mst.dk/Udgiv/publikationer/2018/06/978-87-93710-39-9.pdf
[23] https://www2.mst.dk/Udgiv/publikationer/2018/06/978-87-93710-39-9.pdf

Few materials are exempt, the exemptions are as follows: straw, clean wood waste and wood chip from the wood processing industry, clean soil filling and clean soil, hazardous waste and hospital waste. The exemption for hazardous waste and hospital waste that was initially part of the policy was later changed.

The tax provides an economic incentive for the recycling of waste. Tax rates have increased significantly in the time since the policy's introduction, aiming to help Denmark reach increased recycling targets. The tax was introduced in response to exhaustion of landfill capacity, difficulty in siting new landfills, and recognition for the resources in the waste being sent to landfill. It was intended to promote the development of recycling technologies and diminish the quantity of waste landfilled, inciting companies to apply low waste technologies. It was expected that the tax itself would provide an incentive to reduce waste generation.

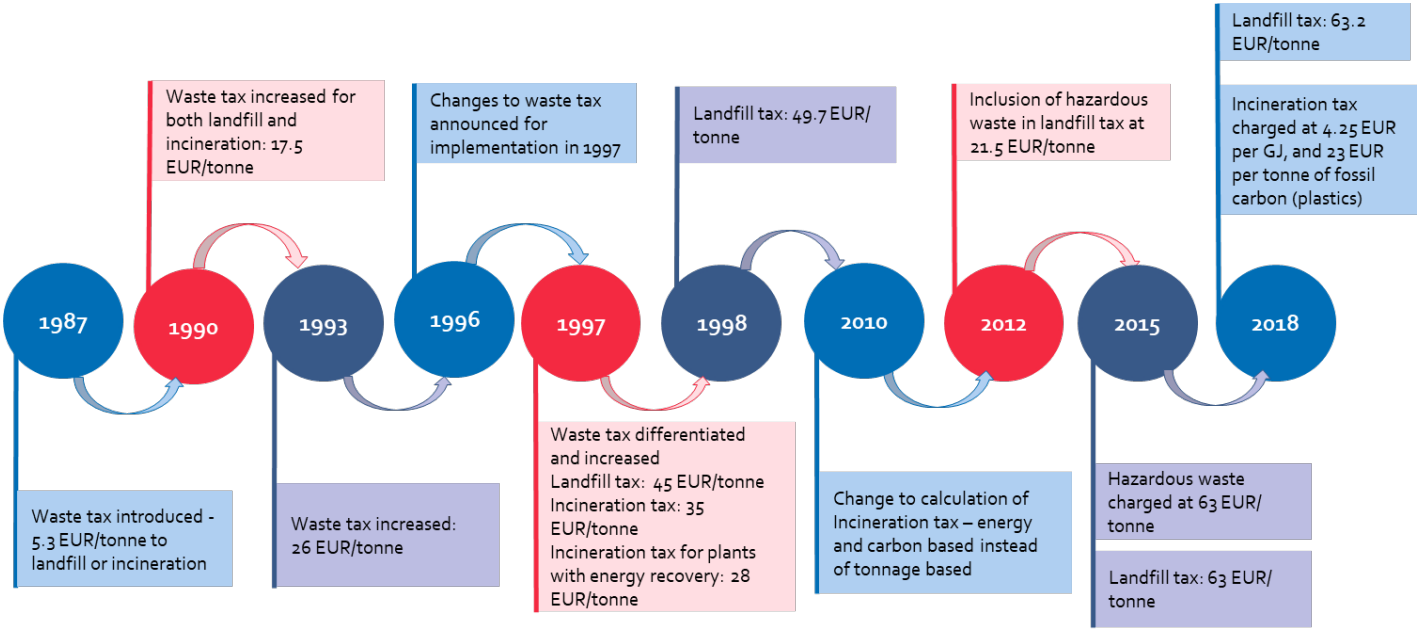
The tax on landfills applies a cost per tonne for waste entering landfill sites, as well as a weight based cost for waste to incineration. It is a charge which seeks to internalise environmental costs of waste management in market transactions. The tax is levied on waste delivered to registered landfills and plants, but a refund is granted for waste subsequently removed for recycling.

The incineration tax was, in 2010, changed to be based on the amount of energy produced and amount of CO_2 emissions produced from the fossil part of the incinerated waste. The yield of the tax is included in the Finance Act as a revenue for the Ministry of the Environment. Part of the yield was initially used to finance subsidy schemes for recycling and clean technology projects. On large incineration plants, emissions are measured and for smaller incineration plants a standard value of 4.25 t CO_2 / TJ is used.[24]

The changes which have occurred to the tax level over the course of its existence are shown in Figure 10.

[24] https://ens.dk/sites/ens.dk/files/CO2/rev_standardfaktorer_for_2017.pdf

Figure 10: Evolution of the Danish Landfill and Incineration Tax



Collection and Regulation of Commercial Waste (1987)

Mandatory collection of some commercial wastes was implemented in 1987. This made collection of paper mandatory for commercial companies, with the exemption of those using private recycling schemes. It also introduced mandatory collection of food waste for recycling as pig feed,[25] and required municipalities to regulate commercial waste and inform companies where they should deliver their waste. In 1990, municipalities were obligated to regulated and secure treatment capacity for all commercial waste for recycling, incineration and landfilling. In most cases, municipalities assigned recyclable commercial waste to private collection companies and private recycling plants, and established own incinerations plants.

The legislation was significantly updated in 2010, when commercial waste regulation was put in place at a national level, banning municipal companies from collecting or receiving commercial waste for recycling. After that, commercial companies were obliged to use nationally approved transport and treatment companies for their recyclable waste.

The initial intention of the policy in 1990 was to increase recycling and secure treatment capacity for commercial waste. The update to legislation in 2010 aimed to commercialise recycling of commercial waste, on the basis that the treatment capacity exists in Denmark.

From 1990, recyclable commercial waste is regulated with the requirement for all companies to separate and recycle their recyclable waste; by municipals until 2010 and after that by state regulation. Municipalities supervise that this is done also after 2010. Collection and treatment of commercial recyclable waste is not the responsibility of the municipality.

Two exemptions to this exist:

- All municipalities are obligated to allow commercial waste on their recycling facilities with payment. The payment can be a general yearly payment for the right to use the facilities or payment per visit/per weight;
- Companies in properties with both commercial and residential occupancy are allowed (but not obligated) to use the municipal recycling schemes. This is used in 13% of the municipalities in Denmark.

[25] This ceased with introduction of the EU animal by-products legislation.

All other collection of recyclable commercial waste is done by private companies.

Waste Bank Collection of Glass, Paper and Cardboard (1990)

Mandatory collection of newspapers, magazines and glass packaging for recycling from households in settlements with more than 2000 households was announced in 1986, and implemented in 1990. Initially, this was delivered via provision of public streetside recycling banks. In 2003, this policy was expanded to cover settlements with more than 1000 households, and it became mandatory to establish household collection if the recycling rate of these materials in the area was below 55%. This was assessed as 55% of the potentially recyclable paper and cardboard arisings.

The aim of the policy was to increase rate of recycling for paper and cardboard to 60%, and contribute towards achieving the EU target of 55% recycling of packaging waste in 2008.

The outcome has been an increase in the number of municipalities which have introduced household collection of paper, with 81% of municipalities now collecting paper from households, and 49% collecting cardboard (Table 5). The majority of municipalities also have public streetside waste banks for glass, and household collections are increasing in number.

Mandatory Municipal Collection of Hazardous Waste (1991)

In 1991, mandatory collection of hazardous waste was introduced with the aims of securing management of hazardous waste and protecting the environment. Initially, the policy covered only oils and chemical wastes but was later changed to all kinds of hazardous waste, including hospital waste.

The policy places responsibility on the municipality to collect hazardous waste from all commercial businesses (except recyclable hazardous waste, which since 2010 is commercialized like other recyclable commercial waste), and obligate households to deliver hazardous waste to a collection point. Private companies are obligated to report generation of hazardous waste and delivery non-recyclable hazardous waste to the municipal collection scheme. As is the case with a number of Danish policies, commercials may be exempt from the municipal collection scheme if they are able to document membership of a sufficient private scheme.

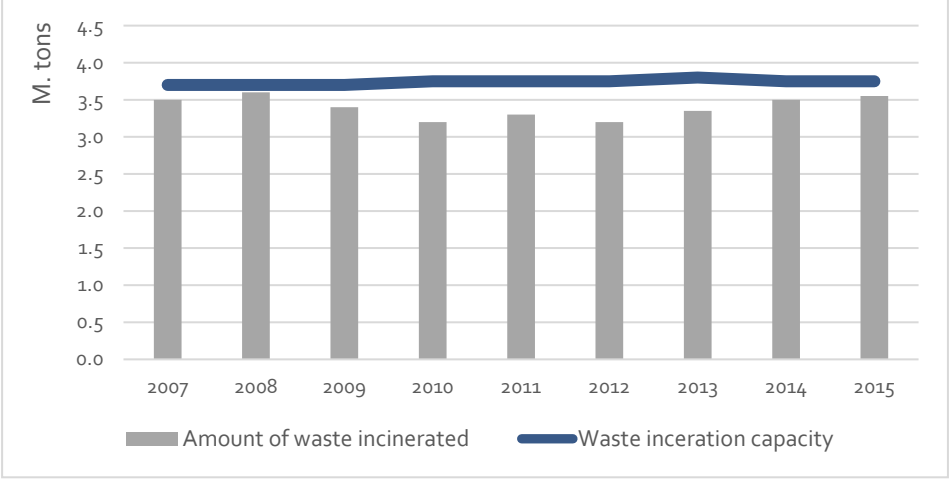
Ban on Landfill of Combustible Waste (1997)

The ban on landfill of combustible waste was announced in 1994, and implemented in 1997, which lead time to allow municipalities to secure sufficient recycling and incineration capacity. The ban covered all combustible waste from households and industry and aimed to reduce landfilling of waste, due to the limited capacity available in Denmark, and to increase energy recovery from waste.

Under the ban, municipalities are obligated to stop landfilling collected waste from households and commercial entities, with the exception of non-recyclable and non-combustible waste. Additionally, to cover commercial and industrial waste management by private companies, these companies are obligated to sort combustible and recyclable waste and deliver this to plants assigned to them by the municipalities (combustible waste) and state (recyclable waste), such that no combustible waste is received by landfills.

Since 2000, there have been changes in the capacity coverage of incineration. Since 2008, there has been a small overcapacity – which is used for treatment of imported waste. The overcapacity is at the moment decreasing and imported amounts are also decreasing (shown in Figure 11).

Figure 11: Amounts of incinerated waste (columns) and waste incineration capacity (line)*



Note: *https://ens.dk/sites/ens.dk/files/Affald/beate_afrapportering_forbraending_2016_29maj2017.pdf

Mandatory Recycling Schemes for Packaging Waste (2006)

First announced in 2000, 2006 saw the introduction of national regulation for mandatory collection of metal and plastic packaging waste from households. A mandatory requirement for collection of paper, cardboard and glass packaging was already in existence at this point and this policy introduced mandatory collection of packaging waste of metal and plastic from households, to increase the prevalence of these waste types being brought to central recycling stations. This was brought in to fulfil the EU PPWD targets and increase recycling of packaging waste. The policy also required municipalities to decide rules for private companies to recycle packaging and transport packaging of glass, metal, plastic and wood at either public or private recycling plants. The legislation does not require a minimum level of service to be implemented. Municipalities may introduce their own schemes, or contract private companies to collect and transport the recyclables. Subsequently, in 2010 municipal regulation of commercial waste was removed so that commercial waste for recycling is handled on the free market. Since this change, municipalities are not allowed to regulate or offer municipal schemes for commercial recyclable waste, except allowing use of municipal recycling stations.

Extended Producer Responsibility Schemes (2005 onwards)

The first producer responsibility schemes were implemented in 2005 for WEEE, followed by end-of-life vehicles (ELVs) in 2007 and batteries and accumulators in 2009. This substituted regulation from the 1990's on WEEE, lead accumulators, nickel-cadmium batteries and end-of-life vehicles, subjecting them to fees or taxes and regulation for sale and collection of the end of life products. The original legislation aimed to increase both collection rates and improve recycling efficiencies, and similar regulation on tyres is still in place. Municipalities have been obligated to collect WEEE from households since 1997. A national independent organisation was established, the Danish Producer Responsibility (DPA) System, initially for WEEE, and later covering batteries and ELVs. The DPA system undertakes administrative tasks associated with Danish producer responsibility for WEEE, ELVs and batteries. This includes the operation of a producer register as well as designing and administering a producer responsibility scheme, designed to be simple and non-distortive for the affected players in the market.

Collection of WEEE from households is undertaken (and financed) by the municipalities. The system was designed before obligations for producers to finance

take-back and waste management and there was no desire for a parallel collection system. From here, producers or Collective Schemes are responsible for managing these. Private companies can also deliver to the municipal recycling stations (but pay for this) or deliver to waste recycling centres operated by producers or Collective Schemes. A small number of large companies have their own systems, but most are covered by collective schemes, who are focusing on effective collection with no incentives for better design, waste prevention or recycling. Collection of batteries is now refunded to the municipalities by the collective schemes.

In the early days of the legislation especially, there were many conflicts of how to collect from the municipal recycling stations by the collective schemes, which can change every year. It is the responsibility of DPA-System to decide which collective scheme organisation should collect from which municipal recycling stations (depending on their market share).

3.2.4 Challenges

Denmark has one of the highest recycling rates of the Nordic Countries and a well-established waste management system. Geographically Denmark contains the largest metropolitan region, Copenhagen, and is the most densely populated Nordic country which comes with its own challenges. Collection coverage via use of bring banks for dry recycling is comprehensive but door to door coverage varies by material (37–81%). Food waste collection is carried out in 42 out of 98 municipalities and has been increasing in recent years. The current composition of residual waste indicates more needs to be done to capture certain materials, particularly paper and cardboard which still have significant quantities in the residual stream. The same is true for organic waste, plastics and other waste types since the composition does not include separate collection of organic waste and plastics. The current set up, where the fee from one collection scheme cannot be used for another, ultimately limits the possibility of further using economic incentives, such as using the fees from residual waste collection to fund recycling schemes. There is currently a volume based system for charging for residual waste collection and weight based systems have not been popular. Overcoming the barriers to implement a weight based system may provide the next logical step to incentivise recycling.

The incineration capacity in Denmark is the highest of all the Nordic countries, calculated as 587 kg per person in 2014:[26] the presence of such high treatment capacity for residual waste is potentially problematic in the light of the revised EU recycling rate targets, and for any waste prevention targets. At present, Denmark is already importing residual waste to fill capacity. In reaching for higher recycling targets, there will be additional capacity freed up (assuming waste growth is not significant, which seems unlikely, as well as being undesirable). High levels of spare incineration capacity, if not filled by imported residual waste, could risk incentivising incineration of waste to fill capacity rather than recycling and therefore could limit recycling rates, managing this risk could be potentially challenging. However, as the municipal companies own incineration plants and recycling schemes, the current economics of importing waste mean it is viable to increase recycling rates in Denmark, whilst importing residual waste to fill incineration capacity.

As with most of the Nordic countries the new definition of municipal recycling will require changes in reporting. The current municipal recycling in Denmark includes a notable amount of wood (Figure 4 which may be excluded from being defined as municipal waste under the new definition. Assuming this is the case, it would result in a 3% reduction in the recycling rate (assuming it is removed from the municipal definition altogether).

Increased recycling of garden waste may also present a challenge in Denmark, as a life cycle assessment has shown it is better to incinerate than compost dry garden waste, and the resource strategy aims for 25% of garden waste to be incinerated.

3.3 Faroe Islands

The Faroe Islands are self-governed parts of the Kingdom of Denmark. They are not members of the internal market, however their legal framework is still highly influenced by EU law, and the legal framework in Denmark particularly.

The Faroe Islands lie in the North Atlantic and consist of 18 islands. Six of the islands, representing more than 85% of the population, are connected by bridges, tunnels and dams. A further eleven islands are connected by ferry or helicopter. The total population stands just under 50,000, of which around 20,000 people live in the capital Tórshavn.

[26] Assessment of waste incineration capacity and waste shipments in Europe (2017).

3.3.1 Current and Historic Trends

The reported waste arisings include commercial and industrial waste collected by the two waste management companies in Faroe Islands covering municipal waste. This makes it difficult to make a comparison between the data for the Faroe Islands and other Nordic regions.

There has been no tradition for data reporting in Faroe Islands. The reporting of data started in 2012 and in the case of recycling, the data are still inadequate. Recycling rates are low, estimated at around 20%, whilst waste arisings are high.[27] The available data indicates that waste arisings have been increasing. Incineration of waste is a major treatment route and the plant on Eysturoy Island has had its capacity expanded by 50%, and extended its lifetime to cope with demand.[28]

Waste generation per capita appears to be particularly high at 1,056 kg/capita in 2016, compared to the EU28 average of 480 kg.[29] This can, at least in part, be attributed to differences in the definition of waste as reported waste arisings include commercial and industrial waste. As mentioned, the two municipal companies in the country manage both household waste and business waste.[30]

[27] COWI (2017) Waste Management in Small Communities - Suggestions for Improvement, 2017.

[28] http://www.volund.dk/Support_and_Service/References/Leirvik_Faroe_Islands

[29] http://ec.europa.eu/eurostat/web/products-eurostat-news/-/DDN-20180123-1

[30] http://www.konkurrensverket.se/globalassets/publikationer/nordiska/nordic-report-2016_waste-management-sector.pdf

Figure 12: Waste Treatment and Recycling Rate in Faroe Islands 2012–2016

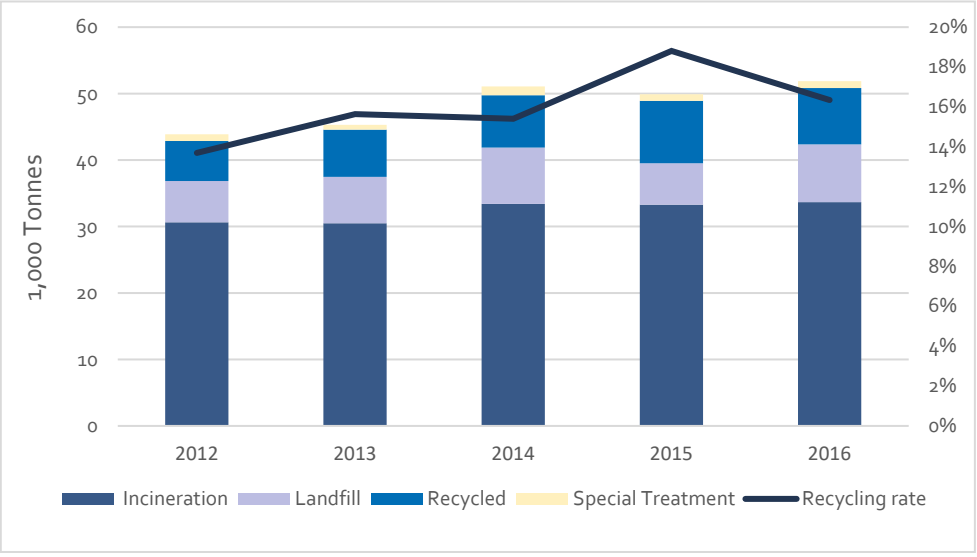
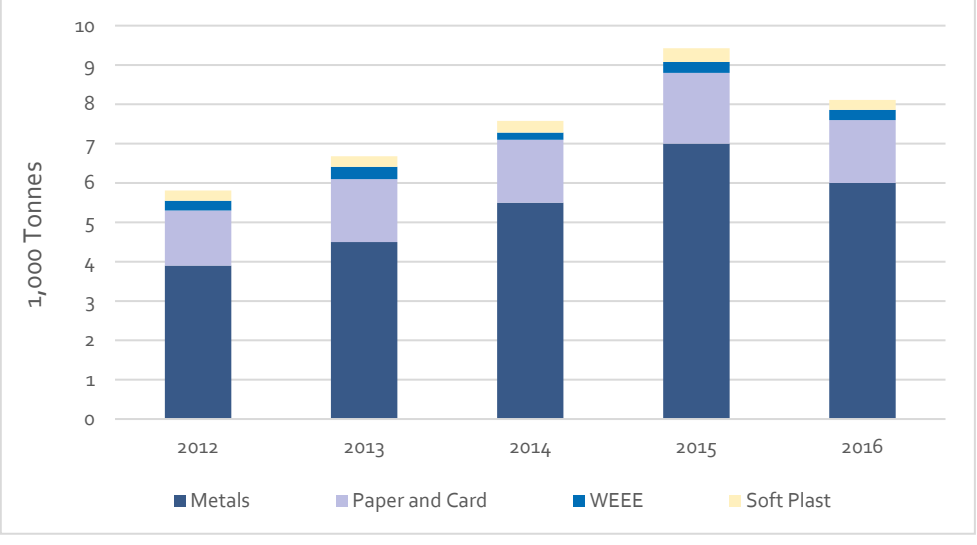


Figure 13: Composition of Recycling in Faroe Islands 2012–2016



Note: The inclusion of soft plastics in this recycling composition, but not within household collection or bring sites, is from business waste.

3.3.2 Approach to Waste Collections

There are two established waste management companies in the Faroe Islands: Kommunala Brennistøðin (KB) which covers Tórshavn, and the inter-municipal Interkommunali Renovatiónsfelagsskapurin L/F (IRF) which covers the remaining 29 municipalities. As such, all Faroe Islands have a waste collection. The companies are responsible for the collection and treatment of waste and each have their own facilities, which include incinerators, landfills and reuse or recycling centres. However, recycling infrastructure is lacking and recyclables are exported.

Household collection of paper, cardboard and hazardous waste is offered. Local receiving stations accept paper and cardboard, metals, organic waste from sheep slaughter, garden waste, electronic waste and hazardous waste. There is no collection scheme for plastic, or household glass.

Some municipal shops for reused materials exist. Largely, these collect and sell used clothing. However, in Tórshavn reuse shops exist covering furniture, bicycles, ornaments, crockery and cooking utensils. The shops are run by Dugni, through an arrangement with KB and IRF. The municipalities and the two waste companies (owned by the municipalities) are planning new schemes for recycling and are currently undertaking test-collections.

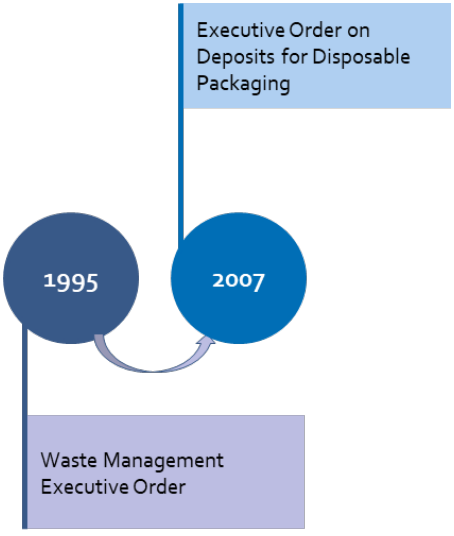
There are EPR schemes in place for certain waste. There is no national strategy on waste management.

The collection and treatment of household waste is financed through national tax. For commercial waste, companies pay a gate fee, set so that the price is lower for clean sorted fractions and higher for mixed waste. The following charges apply for commercial waste received through the waste company IRF which covers 29 Faroese municipalities:

- Source separated paper and cardboard; 40 DKK/m^3
- Comingled paper and cardboard: 80 DKK/m^3
- Metals: Market price
- WEEE: 5 DKK/kg
- Soft transparent plastics: free
- Coloured soft plastic: 50 DKK/m^3
- Waste for incineration: 250 DKK/m^3
- Waste for landfill: 400 DKK/m^3

3.3.3 Policies

Figure 14: Waste policy timeline – Faroe Islands



There are only two main policies for Faroese: the 1995 Waste Management Executive Order (The Executive Order on Law about Waste Management), and the 2007 Executive Order on Deposits for Disposable Packaging.

Executive Order on Law About Waste Management

Faroese Executive order on Law of Waste has been prepared pursuant to the law of Environmental Protection 1988 (Umhvørvisverndalogogin). This Executive Order includes the following requirements:

1. A duty for municipalities to collect household waste frequently (usually once a week);
2. A duty for municipalities to collect hazardous waste (a list of hazardous wastes is included in the order);
3. Municipalities are to ensure that citizens and businesses can get rid of other waste; and
4. Citizens and the businesses have a duty to use the municipal schemes.

The Waste Management Order has not been revised for many years and contains no information on classification, waste hierarchy or objectives for recycling. This is up to the municipalities and the two waste companies.

Deposit System on Disposable Packaging

In 2007, a deposit system on disposable packaging was implemented. This covers glass, aluminium and plastic and achieves a 90% return rate. The law and the notice state that retailers are obliged to charge a deposit when selling disposable packaging and to repay when the packaging is returned.

However, there is no national system as such and the scheme is run by companies selling and distributing disposable packaging. These companies take a deposit when they sell the packaging and return it upon return of the packaging or container. The level of the deposit is DKK 2 for packages that are 0.5 l and less and DKK 4 for larger packages.

The law applies to disposable glass, aluminium and plastic packaging. The executive order states that the law applies to: beer, mineral water, spring water, water, soda, finished mixed juices, cider, energy drinks, sports drinks, ice cream, and punch.

3.3.4 Challenges

Whilst recycling rate in the Faroe Islands is low and data availability is limited there has been evidence of an upwards trend in recycling in the data available. Geographically the Faroe Islands have the same issues of many other Island nations for transport to and from the islands and also within the Faroe Islands, as a collection of 18 islands. Transporting recyclables for reprocessing presents a potential barrier. Waste collections are organised for refuse and dry recycling is covered through household collection and receiving stations. Notable there is no collection of plastic, household glass or food waste. There is no recycling industry and recyclables are shipped to Europe for treatment. Incineration capacity has been expanded so that residual waste can be managed within the Faroe Islands. Waste policy in the Faroe Islands is lacking and there is no national strategy on waste management. Despite Faroese legislation requiring a national waste management plan, this is not in place and as the Faroe Islands is not member of the EU and there are no targets in place for increasing recycling.

3.4 Finland

Finland has a population of 5.5 million with the majority concentrated into the southern region, particularly in Helsinki, with the Greater Helsinki Metropolitan region having a population of 1.4 million. Finland is the most sparsely populated country in the European Union.

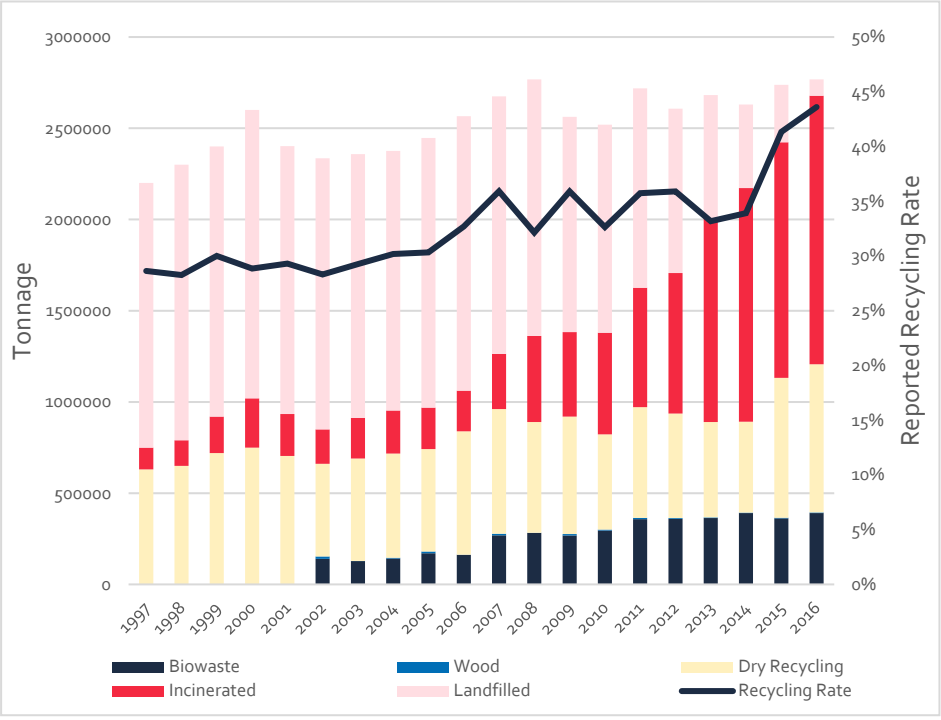
There are 311 municipalities in Finland and these are responsible for the waste management of households, public services, social and healthcare services and educational services. The current national waste plan was published in December 2017 and outlines overall ambitions to 2023. National waste management plans are partly implemented through regional waste management plans that aim to reflect the regional differences in the waste management and geography.

3.4.1 Current and Historic trends

The current household recycling rate in Finland is reported at 44% (2016), the trend is illustrated in Figure 15.

The reporting system has been refined over the years. The initial system allowed for rough recording of waste data: waste was separated into that sent for material recovery, incineration and landfill, and numbers were rounded to the nearest 1,000 tonnes. In 2002, waste streams were recorded separately in the statistics and from 2007, the figures were recorded in exact tonnages without rounding. Over the time period during which data are available, whilst the recycling rate has generally increased, there have been some fluctuations, and this upwards trend has been relatively modest until the most recent years. Reflecting investment in waste to energy technologies landfill has decreased and incineration has increased.

Figure 15: Household Waste Arisings in Finland by Treatment Route and Recycling Rate



Municipal waste refers to waste that has been generated in permanent residences, summer houses or other residences: it includes waste from septic tanks and sludge cesspools. It also includes similar waste from administrative, service or commercial and industrial activity. The principal difference between the Finnish definition and the new WFD definition is that the Finnish definition includes septic tank and sludge, both of which are specifically excluded under the WFD definition. Recycling is counted as input to a recycling operation, rather than any of the intermediate stages, and may, therefore, be in closer alignment with the revised WFD point of measurement than some other countries.

3.4.2 *Approach to Waste Collections*

Finnish waste collection primarily consists of a mixture of five methods:

- Door-to-door collections
- Bring sites
- Recycling stations
- A deposit return system
- Campaign collections for specific waste streams

Finnish waste collection services are almost fully outsourced, with only one municipality complementing its outsourced services with some additional in-house waste collection vehicles.[31] The coverage of households by door-to-door collection services is variable and (currently) mainly determined by the density of housing, with multi-family blocks being most likely to be offered collections of all types of waste door to door.

Householders pay for their waste to be collected. The waste charge consists of combined transportation and treatment costs. The level of this charge is based on the waste stream, its quality, quantity, frequency of the collections, and the conditions of the collection site, taking into account use of municipal collection equipment and the transport distance. Alternatively, the charges may be based on number of residents and the purpose of use of the estate (e.g. if it is a summer house then waste charges are less). The extent of door to door collection varies widely by housing type, with detached houses having minimal coverage even in densely populated areas. The coverage is shown in Table 7.

[31] http://www.renonorden.com/about/our-story/

Table 7: Coverage of door to door collections in Finland[32]

Type	Apartments			Row houses			Detached houses		Total
	<10	10–19	>19	2–4	5–9	>9	Densely populated	Sparsely populated	
Inhabitants	172,730	412,533	1,282,470	311,994	342,232	43,746	1,909,120	774,219	5,249,044
Coverage %									
Biowaste	44%	87%	87%	18%	43%	78%	20%*	20%*	44%
Paperboard & Cardboard	11%	68%	83%	14%	12%	55%	0%	0%	28%
Glass	18%	34%	76%	7%	22%	40%	0%	0%	24%
Metal	18%	38%	79%	7%	23%	43%	1%	0%	26%
Paper	100%	100%	100%	100%	100%	100%	0%	0%	49%
Plastic	0%	0%	0%	0%	0%	0%	0%	0%	0%

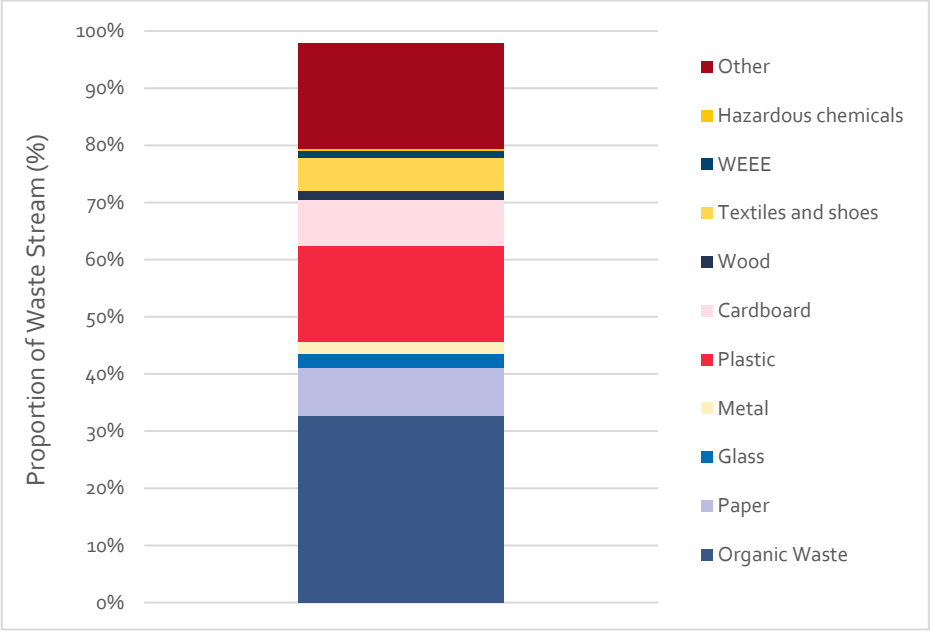
Note: * incl. home composting.

3.4.3 *Waste Composition*

The composition of household waste in Finland is shown in Figure 16. The current composition shows potential for increasing recycling in excess of 65% EU target without the need for targeting different or niche materials (i.e. from organics, paper, glass, metal, plastic and cardboard).

[32] Aalto University: *Recycling potential of municipal solid waste in Finland* https://aaltodoc.aalto.fi/handle/123456789/28097

Figure 16: Finnish Household Waste Composition by KIVO from most recent year (completed every 2–3 years)



3.4.4 *Existing facilities*

In 2015, there were 61 biogas plants and 199 composting plants in operation in Finland. These plants treat biowastes beyond those obtained from households.

The total number of non-hazardous waste landfills was 113, with a further 40 landfills dealing with inert waste. 34 landfills were available which dealt with hazardous waste.

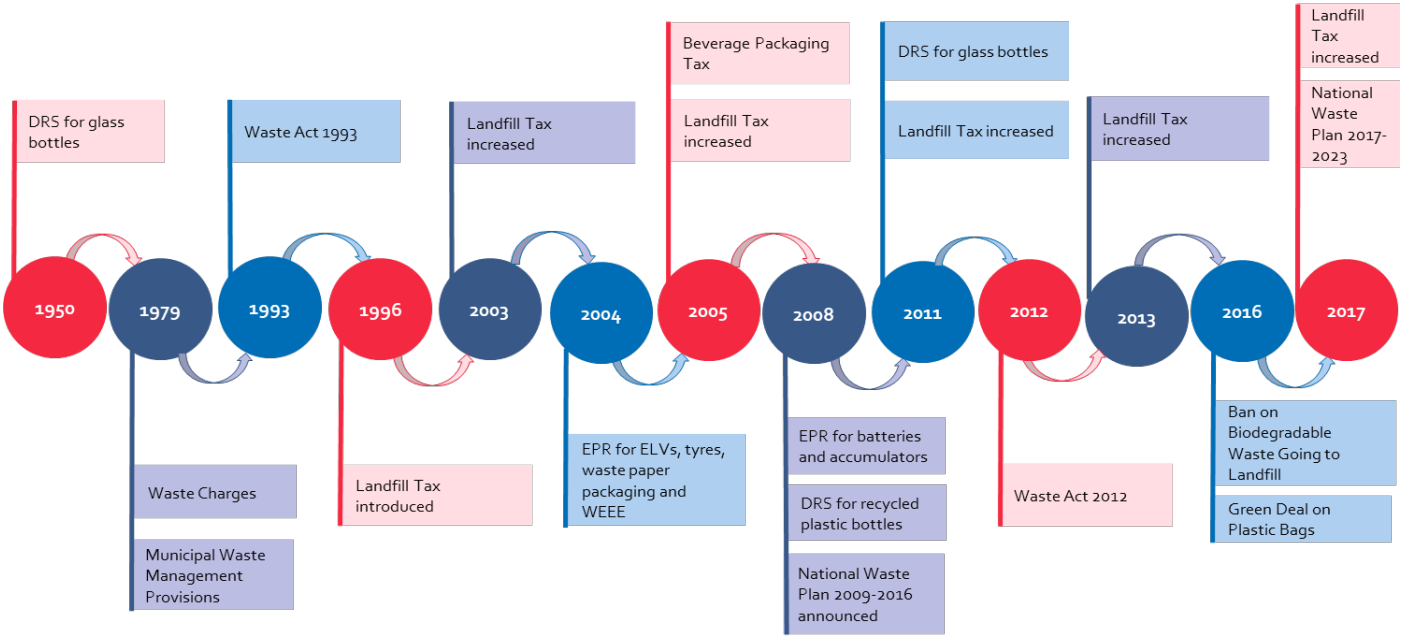
There were 9 waste incineration plants in operation in 2015. Besides municipal waste, they also incinerate waste from other sources. 25 plants were licensed as waste co-incineration plants. They combust source separated wastes from industry, commerce and municipalities. Additionally, 73 power plants used industrial by-products and wastes from in-company circulation in addition to conventional fuels. There is one high temperature incineration plant for hazardous waste in operation in Finland.

A large proportion of the hazardous waste generated is disposed of centrally in the specialized hazardous waste disposal plant Fortum Ltd in Riihimäki. Besides this, hazardous wastes are disposed of in other installations, and some in specifically engineered landfill sites. The figures for waste management infrastructure include Åland. Mixed municipal waste is transported from Åland to mainland Finland for disposal or recovery and to Sweden for recovery.

3.4.5 Policies

The timeline for the main policies affecting waste in Finland is shown in Figure 17. The landfill tax on waste treatment has had, perhaps, the most notable effect, as shown in Figure 15, reducing the amount of landfilling from 66% of waste collected in 1997 to just 3% in 2016. The effects are explored fully in the econometric analysis. This switch has occurred primarily through increasing incineration rather than recycling, although some increase in recycling has also taken place.

Figure 17: Policy timeline for Finland



The explicit provision for the separation of waste has existed in Finland since the 1930s. However it was in the Waste Act of 2012 that the provisions were more clearly formulated. Within the Waste Act 2012 it was specified that wastes that are different in type or quality are collected separately when this is necessary for:

- protection of environment and human health;
- following the waste hierarchy; or
- to provide appropriate waste management that is technically and economically feasible.

The separate collection of paper has long been in place; separate biowaste collection began in 1993, and was further encouraged by the ban on organic waste in landfill sites in 2016 (announced in 2013), and separate plastic collection was introduced in 2016.

Deposit System for Beverage Containers (1950)

In 1950, Finland introduced a deposit return scheme for glass bottles for washing and reuse which has been expanded to cover other beverage containers over the years, with aluminium cans included from 1996, plastic bottles from 2008 and glass bottles for recycling rather than reuse from 2011. In 2015, return rates achieved were between 89% and 95% for one-way packaging.[33] The level of deposit for different beverage packaging has remained somewhat the same from the beginning of 1990, however slight changes were made in 2002 when Finland transitioned to the Euro to allow the deposit to function neatly with the new currency. These levels are:

- EUR 0,10 for glass bottles
- EUR 0,15 for aluminium cans
- EUR 0,10 for <0.5l plastic bottles
- EUR 0,20 for 0,5l plastic bottles
- EUR 0,40 for 1,5l plastic bottles

[33] https://ieep.eu/uploads/articles/attachments/9d526526-d22b-4350-a590-6ff71d058add/FI%20Deposit%20Refund%20Scheme%20final.pdf?v=63680923242

The Finnish Government has issued a decree on the recycling objectives of return systems and the minimum values of different beverage package deposits. In practice, most beverage manufacturers and importers are members of return systems managed by Suomen Palautuspakkaus Oy, or Palpa. By becoming members of Palpa's return systems, beverage manufacturers and importers are exempted from the beverage packaging tax. The beverage packaging tax has been in place since 1994. This incentivises participation in the deposit refund system by offering a lower rate of tax for participants in a registered deposit refund system. Until 2005, only refillable bottles in a deposit refund system were exempt from the tax entirely, with one-way containers still liable to pay between 12.5% and 25% of the tax. From 2008, one-way containers were also exempt from the tax if in a deposit refund system. This change in the tax has been credited as the main driver for the switch from refillable to one-way containers in Finland over the last ten or so years.

In 2016, the deposit system achieved a total return rate of 92%, with individual material return rates at 96% for cans, 92% for PET and 88% for glass.[34]

Waste Charges (1979)

Waste charges were implemented in 1979, aiming to cover the costs of municipal waste management in Finland whilst reducing waste generation. The waste charge provides an economic incentive for households to sort waste and reduce the quantity of waste they generate. Waste charges vary between municipalities, but in many, a smaller fee is charged for waste that is sorted and fit for recycling as opposed to for mixed waste – providing an incentive for sorting of recyclables. Waste charging is aimed at covering the costs of municipal waste management and reducing waste generation via economic incentives. The waste charge is required to be in line with the service level provided by the municipality. All municipalities in Finland use a "pay as you throw" (PAYT) scheme where the waste fee is based on bin volume and emptying frequency of bins. Weight based systems are used only in a few municipalities.

[34] Reloop, and CM Consulting (2018) *Deposit Systems for One Way Beverage Containers: A Global Overview*, 2018, https://reloopplatform.eu/wp-content/uploads/2018/05/BOOK-Deposit-Global-27-APR2018.pdf

Municipal Waste Management Provisions (1979)

In 1979, municipalities were given the authority to manage their own waste, the responsibilities included:

- reduction, sorting, storage, collection, transport, recovery and disposal of municipal waste;
- preventing hazard and harm caused by waste and waste management;
- practical arrangements at properties or waste reception points for the collection, reception and transport of waste;
- implementation of measures to prevent littering; and
- an obligation to submit information to the municipal waste management authority or municipal environmental protection authority on waste (i.e. waste management companies must report to the municipality).

Finnish Landfill Tax (1996)

The Finnish landfill tax was introduced in 1996 for waste entering landfill sites and is levied providing that:[35]

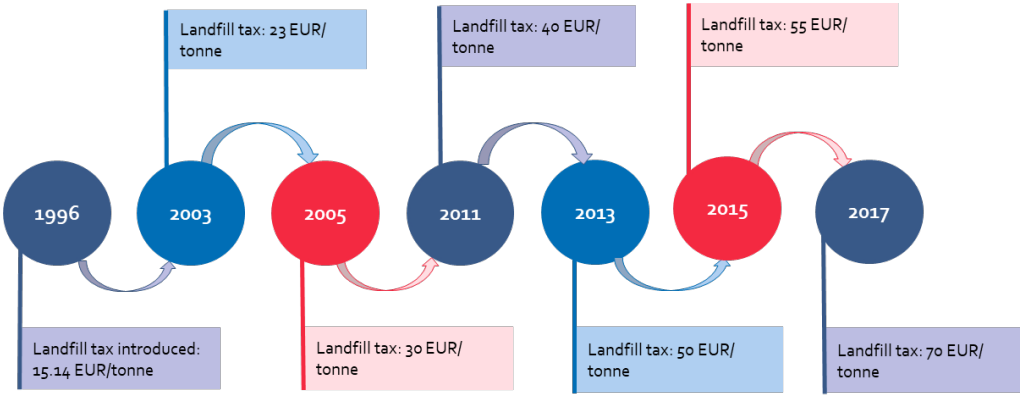
- its utilisation is technically feasible and environmentally justifiable; and
- That by imposing the tax, waste can be made more commercially exploitable.

Waste categories with no technical treatment or utilisation alternative to disposal at landfills, or with utilisation options that would do more harm than good, are tax exempt. Such categories include mineral waste and waste from inorganic chemical processes. Another category exempt from the tax is hazardous waste deposited at landfills. Waste used in the structure of landfills, in a manner that the permit or supervisory authority deems acceptable, is also tax exempt. All landfills where waste falling into a taxable waste category is deposited are subject to the waste tax. This covers both public and private landfills, as well as all waste disposal areas. In keeping with the previous Waste Tax Act, storage of waste lasting less than three years, waste composting or utilisation areas and dumping areas, are not subject to the waste tax.

[35] The Waste Tax Act (1126/2010).

The tax has risen over time from EUR 15.14/t in 1996 to EUR 70/t in 2017, as shown in Figure 18.

Figure 18: Timeline showing development of Finland's landfill tax



Extended Producer Responsibility Schemes (2004)

The first extended producer responsibility schemes (EPR) were implemented in Finland in 2004 for:

- cars, vans and comparable vehicles;
- tyres from motor vehicles, other vehicles and equipment as well as vehicles or equipment supplied with tyres (including tyre re-treading companies);
- electronic and electrical appliances;
- batteries and accumulators;
- printing paper and paper for manufacturing other paper products; and
- packaging where the producer responsibility pertains to the packers of the products and importers of packaged products, but excluding the packaging producers.

Producers are obliged to fulfil their producer responsibility in one of the following manners:

- by joining a producer organisation which then handles the obligations set out in the waste act on behalf of the producer;
- by submitting to the Pirkanmaa ELY Centre an application for registration in the producer database, in which case the producer itself shall handle the collection, recycling and waste management of the products falling under producer responsibility; or
- by establishing a producer organisation together with other producers.

If a company's producer responsibility pertains to several areas of responsibility (for example, electronic and electrical appliances as well as packaging), the company has to organise its producer responsibility separately for each area.

Since its introduction, the EPR scheme in Finland has been extended. In 2008, EPR was extended to include batteries and accumulators which were not covered under the initial version of the policy. In 2014, a packaging decree was introduced which set stricter targets for packaging for the period from 2016 to 2020.

Producers are required to organise a separate collection and recycling for fibre and wooden packaging, starting from January 2016. This collection must achieve the following recycling rates:

- 80% for fibre packaging; and
- 17% for wooden packaging.

Producers of glass, metal or plastic packaging have to comply with following annual recycling rates as of January 2016:

- 27% (40%, in 2020) for glass packaging;
- 75% (80% in 2020) for metal packaging;
- 16% (22% in 2020) for plastic packaging.

These are below the EU targets but have been confirmed as correct. Firms that have producer responsibility have also been responsible for organising the collection of consumer packaging in Finland since January 2016. The Rinki eco take-back point network launched its operations at the same time. Consumers can return used carton, glass, metal and plastic packaging to the Rinki eco take-back points.

Beverage Packaging Tax

As of 1 January 2005 (Act 1037/2004A), a beverage packaging tax of EUR 0.51 per litre is collected for the packaging of certain alcoholic beverages and soft drinks, but by becoming a member of an approved and operational return system or organising a new return system, producers are exempt from the tax.

Ban on Biodegradable Wastes Going to Landfill (2016)

The ban on biodegradable waste going to landfill was announced in 2013 and implemented in 2016. This ban includes all biodegradable waste or other waste in which the content of organic matter is over 10% (defined as the total content of organic carbon or loss on ignition) it includes biowastes, textiles, wooden waste, waste paper etc. and is effectively a ban on the landfill of all mixed waste. This is as collecting some biowaste upstream would not satisfy the conditions of the ban, as such, all biowastes either need to be all collected upstream or all mixed waste must be diverted from landfill.

For organic waste to be landfilled, it must be justified that there is no other suitable waste management alternative for the waste, which is not easy and would increase costs. The ban makes disposal of mixed waste containing organic wastes via landfilling challenging, so this would continue to provide an incentive to municipalities to collect more biowastes, or encourage them to pursue alternative treatment by incineration. Whilst a large proportion of the effect has been to stimulate investment in mixed waste to energy plants, the composting and digesting rate has increased due to additional biowaste collections and treatment at in vessel composting (IVC) and anaerobic digestion (AD) plants. The Finnish Ministry of Environment (MoE) does not have information on which municipalities or catering businesses have implemented biowaste collections, so the exact scale of the changes is not known, but some further action may be expected. The recent change has been around a 1% increase per year in separately collected biowaste, so an increase of 0.5% is assumed from 2016 to 2018 and 0.25% from 2019 to 2020, as the effect of the ban weakens. The net increase is estimated at 2% by 2020.

Green Deal on Plastic Bags (2016)

A programme of measures under the Finnish Marine Strategy 2016–2021 adopted by the Government proposes measures to be taken to reduce the amount of plastic litter. The aim of the strategy is to reduce littering of the Baltic Sea. The measures address the use of plastic containers and bags. Joint actions have been agreed to undertake measures required by the PPWD to reduce the consumption of lightweight plastic carrier bags. The purpose of the "Green deal" agreement is to agree on voluntary measures for the retail sector to ensure that the minimum objectives concerning the consumption of lightweight plastic carrier bags in the PPWD are reached in Finland. The objective of this agreement is that the related measures contribute to fulfilling the objective specified in the above-mentioned provision, which is that the annual consumption level does not exceed 40 lightweight plastic carrier bags per person by 31 December 2025. The consumption levels of very lightweight plastic carrier bags are excluded from the objectives.

National Waste Plan (2009–2016)

This waste plan included targets (all for 2016) on:

- 50% of all municipal waste is recycled as material and 30% used as energy;
- not more than 20% of the total municipal waste should be landfilled;
- at least 70% of all construction waste will be used as material and energy; and
- 5% (3–4 million tonnes) of the gravel and crushed stone used in earthworks will have been replaced by waste generated by industry and mineral extraction.

There was deemed to be not enough information available on other industrial waste categories in order to set quantitative objectives, the plan envisaged individual sectors setting their own material-efficiency agreements and targets for waste reduction and increasing recycling rates.

The National Waste Plan incorporates Finland's national plan for preventing waste generation. There are a number of specific waste prevention aims which are included in the plan:

- Finland will promote the incorporation of material efficiency criteria in product standards, implementation provisions covering the ecological development of energy-using products, ecolabels and quality criteria covering public procurement;
- the minimum requirements laid down in consumer protection legislation and its application guidelines covering labelling and warranties will be revised;
- studies will be carried out on which natural resources should, from the point of view of environmental policy, be subjected to economic steering and how feasible such steering would be;
- sectoral agreements will be concluded on a trial basis as an instrument for increasing material efficiency in production;
- services aimed at improving waste management and material efficiency in SMEs will be developed;
- provision of advise aimed at preventing waste generation will be made more efficient; and
- national advisory support services and information material on material efficiency will be provided.

National Waste Plan (2017–2023)

Finland's current, and third, NWP was announced in 2016, and implemented in December 2017. It will run to 2023 and aims to see Finland transition "from recycling to a circular economy". The plan particularly targets four waste streams: construction and demolition waste, biodegradable waste and nutrient cycles, (WEEE), and municipal waste. The targets are outlined in Table 8.

Table 8: Key targets in Finland National Waste Plan (2017–2023)

Construction and demolition waste	Biodegradable waste	Municipal waste targets	WEEE
Reducing the volume of construction and demolition waste	Halving food waste and food loss by 2030	Recycling 55% of municipal waste*	Prolonging the lifespans of EEE and increasing their utilisation rate
Raising the recovery rate of construction and demolition waste to 70%	Recycling 60% of the biowaste included in all municipal waste generated	Increasing the recycling of packaging waste	Reducing the share of WEEE in mixed waste and boosting its recycling
Increasing the recovery of construction and demolition waste while managing related risks	Increasing the use of fertiliser products made from recycled raw materials to replace fertilisers made from virgin raw materials		Reclaiming and recycling critical raw materials and valuable materials in WEEE more effectively
Achieving greater accuracy and correctness in statistics on construction and demolition waste	Slowing down the growth of the volume of municipal waste relative to GDP and achieving relative decoupling		Removing harmful substances in WEEE from circulation
			Stepping up the supervision of the exports of used EEE and WEEE

Note: * This has already obsolete given the recycling targets in the revised Waste Framework Directive.

3.4.6 Challenges

Finland's recycling rate has been steadily increasing, but still falls short of the 50% target and many of its Nordic neighbours. Finland is very rural in places with low population densities. Door-to-door recycling collections have not been prioritised and there is no comprehensive coverage of door-to-door recycling and instead this is complemented with bring banks. The rurality of some regions of Finland also poses a challenge as, whilst door-to-door collection is likely to provide increased recycling, this is less economically viable in some of the most rural regions. In particular, biowaste collection is currently not available in many of the more rural regions. However, even in densely populated regions, individual households generally do not have door-to-door collection for biowastes and other recycling streams, whilst mixed waste is collected almost exclusively door-to-door. For many residents, it is therefore easier to dispose of

mixed waste than deliver recycling to dedicated collection points. Finland's current EPR system includes packaging and Producer Responsibility Organisations (PRO)s can define how they collect their waste streams, often utilising bring banks they provide may not always be situated in a way that maximises recycling. For municipalities, since they do not receive the benefits of additional recycling income, as this goes to the PROs (at least for the packaging material they cover), there is less financial incentives for moving recyclate (covered by PROs) out of mixed waste. The current EPR scheme in place in Finland means there is a lack of incentives for Producer Responsibility Organisations (PRO)s to collect additional recyclate once targets are reached. The present set up is that PROs do not contribute to any management costs if their packaging is deposited in the residual waste stream, only if it is separately collected.

Incineration capacity in Finland has grown six-fold in the last decade[36] and in 2014 the incineration capacity was quantified as 220 kg/per person,[37] with a total of nine incinerators in operation and construction ongoing on new incinerators. The capacity requirements are outlined within Finland's waste management plans, but with a 55% recycling target these are not yet in alignment with the capacity requirements of reaching a 65% recycling rate and therefore risk an overcapacity of residual waste treatment.

3.5 Greenland

Greenland is an autonomous country within the Kingdom of Denmark, located between the Arctic and Atlantic Oceans. It consists of a main island, and around 100 islets. In 2018, Greenland's population was ~56,000 making it one of the world's least densely populated countries.[38] Greenland is divided into five municipalities and waste management is considered a municipal responsibility.[39] Nuuk, Greenland's capital is the most populous town, with 17,000 inhabitants in 2018.[40] The remaining settlements are

[36] Incineration and recycling of waste have replaced landfills for municipal waste (20th December 2016) https://www.stat.fi/til/jate/2015/jate_2015_2016-12-20_tie_001_en.html

[37] Assessment of waste incineration capacity and waste shipments in Europe (2017)

[38] Statistics Greenland (2018) *Greenland in Figures, 2018,* http://www.stat.gl/publ/en/GF/2018/pdf/Greenland%20in%20Figures%202018.pdf

[39] Naalakkersuisut, Increased focus on waste transport, https://naalakkersuisut.gl/da/Naalakkersuisut/Nyheder/2017/11/2411_affald

[40] Statistics Greenland (2018) *Greenland in Figures, 2018,* http://www.stat.gl/publ/en/GF/2018/pdf/Greenland%20in%20Figures%202018.pdf

found mainly along the coast (primarily on the West coast), with six relatively big towns, 11 smaller towns and around sixty settlements with 30–300 inhabitants.[41] As such, the waste collection and management challenges faced by Greenland differ from those in the more densely populated Nordic countries.

Transport of recyclables presents a significant challenge as 81% of Greenland's area is covered by ice, and road networks are very limited, with no roads connecting towns and settlements to one another. Transport is predominantly by sea and by air, both of which depend on suitable weather conditions for operation.[42] Due to its isolation, waste treatment options in Greenland are more limited than in other Nordic states, and little waste is recycled.

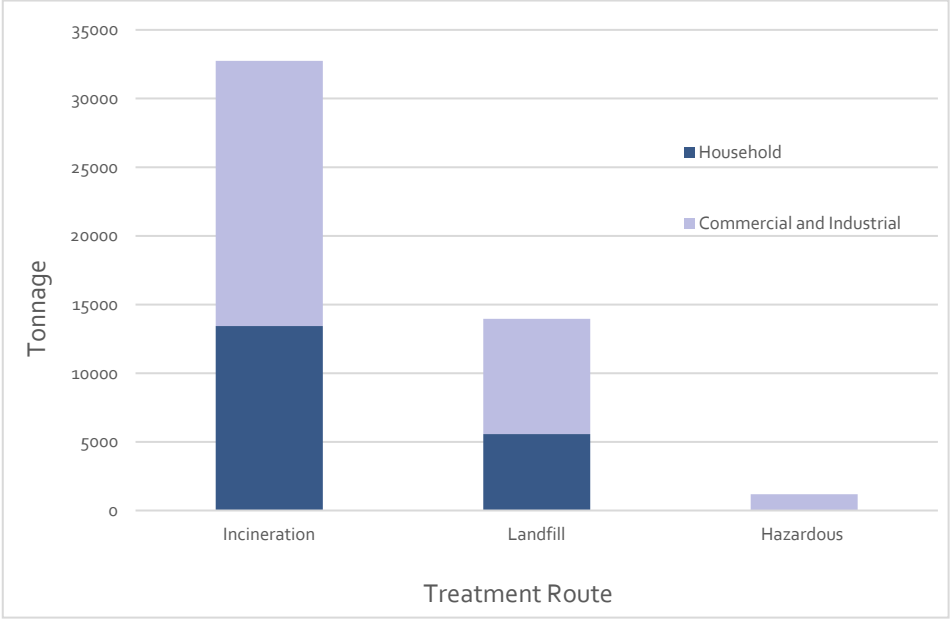
3.5.1 Current and Historic trends

No data were available for Greenland to report on historic trends in waste treatment and recycling. This is because no aggregated data are collected from waste management systems in Greenland. Some data are collected by treatment plants. Weight data are available in one of the municipalities but there is no systematic collection of data and no overview for Greenland. It is worth recognising that collection of data would be an important change which Greenland could make going forwards, so that the impact of changes in waste management policy and practice can be recorded, and progress towards targets can be assessed.

[41] Statistics Greenland (2013) *Greenland in Figures, 2013,*
http://www.stat.gl/publ/en/GF/2013/pdf/Greenland%20in%20Figures%202013.pdf
[42] Statistics Greenland (2018) *Greenland in Figures, 2018,*
http://www.stat.gl/publ/en/GF/2018/pdf/Greenland%20in%20Figures%202018.pdf

One existing study looked at estimating waste management and treatment in Greenland. The findings (estimated) for 2015 are shown in Figure 19.[43] 70.7% of household waste and 67.7% of commercial waste was incinerated, with the remainder going to landfill. Also based on these figures, household waste generation in Greenland stands at around 340 kg/inhabitant/year in 2015. Commercial waste generation was higher, at around 515 kg/inhabitant/year in 2015. In terms of composition, household waste in Greenland has a high proportion of organic waste and a low paper/cardboard content – however, this is based on data from 2011 from Sisimut, and as such, composition may have undergone a shift since.[44,45]

Figure 19: Estimated Waste Generation and Management for Greenland in 2015



[43] Nordic Ministers Council, May 2017, *Waste handling in small communities*. Report by COWI.

[44] Eisted, R., and Christensen, T. (2013) Environmental assessment of waste management in Greenland: Current practice and potential future developments, *Waste Management & Research, The Journal of the International Solid Wastes and Public Cleansing Association*, ISWA, Vol.31.

[45] Eisted R and Christensen TH (2011b) Characterization of household waste in Greenland. *Waste Management* 31: 1461–1466.

3.5.2 Approach to Waste Collections

For the majority of towns and villages in Greenland, waste is disposed of in open dumps that are not environmentally regulated or protected. The largest six towns (home to ~60% of the population) have small-scale incinerators, where some waste is incinerated.[46,47] However, some of these incineration plants do not have enough capacity, or do not function sufficiently, to treat all burnable waste. This is the case in Sisimiut and Ilulissat, leading to landfill of combustible waste.[48,49] Waste that is not incinerated is usually landfilled in open dumps, where it is burned off infrequently to create space for more waste. Some of the smaller settlements have very small incinerators with limited environmental protection. Waste is also incinerated in an uncontrolled way via burning in open dumps or burning on a smaller scale. Combustible waste may also be deposited in landfills.

However, Greenland's government is taking action to improve the country's waste disposal facilities. The Government has recognised that many of the small-scale incinerators are substandard, which has contributed to a 30% deficit in incineration capacity, and is taking steps to expand the national capacity for dealing with Greenland's waste.[50] In 2018, the Government reached an agreement with the Mayors of the municipalities to establish a joint municipal waste disposal company and build two large-scale incineration plants. This represents a move away from reliance on local, small-scale incinerators towards increased transportation of waste across Greenland to large, nationwide facilities.[51] It is expected that the new large-scale plants will be located in Sisimut, and in Nuuk.

Historically, there has been a lack of infrastructure between towns and settlements which has prevented transportation of waste from small settlements to incineration plants. The Government has provided funding to the municipalities to subsidise waste

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[46] Eisted, R., and Christensen, T. (2013) Environmental assessment of waste management in Greenland: Current practice and potential future developments, *Waste Management & Research, The Journal of the International Solid Wastes and Public Cleansing Association*, ISWA, Vol.31.

[47] European Environment Agency (2012) *Waste in Greenland, 2012*.

[48] Naalakkersuisut (2015) *Waste Sector Plan*.

[49] Qeqatta Kommunia (2016) Qeqatta Waste Sector Plan 2017-2020.

[50] Naalakkersuisut, *New national solution in the waste area* (2018) https://naalakkersuisut.gl/da/Naalakkersuisut/Nyheder/2018/09/260918-Ny-national-loesning-paa-affaldsomraadet

[51] Naalakkersuisut, *New national solution in the waste area* (2018) https://naalakkersuisut.gl/da/Naalakkersuisut/Nyheder/2018/09/260918-Ny-national-loesning-paa-affaldsomraadet

transportation initiatives and find solutions to their waste transportation issues.[52,53] As of 2017, each of the municipalities have initiated waste transportation projects.[54]

Waste is collected from households and commercial holdings on at least a weekly basis by the municipalities, with collection frequency as high as three times per week in some areas. Electronic and hazardous waste is shipped to Denmark, and the waste reception facilities in the largest towns dismantle electronic waste and handle storage of hazardous waste for shipping. Return to Denmark makes use of backhauling on ships which are importing goods to Greenland and travelling back to Denmark (with excess capacity).

In most cities there are systems for bringing large metal wastes to be collected. This is shipped ad hoc in connection with clean up from local dumps. In the Kujalleq and Qeqqata municipalities, collection pilot schemes have been set up for glass packaging. In Kujalleq the collected glass is landfilled and in Qeqqata it is crushed and recycled, being used as a drainage layer in trenches and paths or mixed into asphalt.[55]

In all municipalities, usable bulky waste is required to be sorted for direct reuse. However, Kujalleq has no current resources for screening waste for direct reuse; in Qeqqata a container is provided where reusable items can be deposited for other residents to collect. Information is lacking on arrangements for direct reuse of waste from Sermersooq or Qaasuitsup.[56]

In some municipalities, pilot or trial schemes exist for recycling of some waste streams but the majority of these are small scale. Qeqqata municipality ran a pilot scheme for households trialling the separation of food waste. Collected food waste was composted, then used as cover material for the open-dump type landfills. However, Qeqatta reported that whilst the pilot trial was successful in allowing composting of this waste it resulted in strong odours and attracted pests and careful consideration would be given to pursuing this path in future.[57] Wood waste is used as a structural material in composting of food waste in Sisimut, and in Maniitsoq it is incinerated. There is no information from other municipalities on arrangements for wood recycling or reuse.

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[52] Naalakkersuisut, *Million initiative for better environment in settlements and cities*, https://naalakkersuisut.gl/da/Naalakkersuisut/Nyheder/2017/04/030417_bedre_miljoe

[53] Naalakkersuisut, *Naalakkersuisut allocates DKK 13.5 million. kroner for better waste management* (2018) https://naalakkersuisut.gl/da/Naalakkersuisut/Nyheder/2018/06/220618-13_5-mio-kroner-til-bedre-affaldshaandtering

[54] Naalakkersuisut, *Increased focus on waste transport* (2017) https://naalakkersuisut.gl/da/Naalakkersuisut/Nyheder/2017/11/2411_affald

[55] COWI (2017) *Waste Management in Small Communities - Suggestions for Improvement, 2017.*

[56] COWI (2017) *Waste Management in Small Communities - Suggestions for Improvement, 2017.*

[57] Qeqatta Kommunia (2016) *Qeqatta Waste Sector Plan 2017-2020*, 2016.

Sermersooq Paamiut has introduced a voluntary collection scheme for paper and cardboard, however, it is unclear what the fate of this material is.

Finally, in all the cities and most of the settlements, reception facilities have been established for electronic waste, fridges and freezers and hazardous waste.

As such, aside batteries and bulky waste including small and large electronic waste, Greenland has not established mechanisms for recyclable waste fractions. Due to the lack of national waste data collection and recording, it is not possible to estimate reliably what Greenland's current recycling rate is. However, based on the limited infrastructure to facilitate recycling, it is expected that the rate would be low.

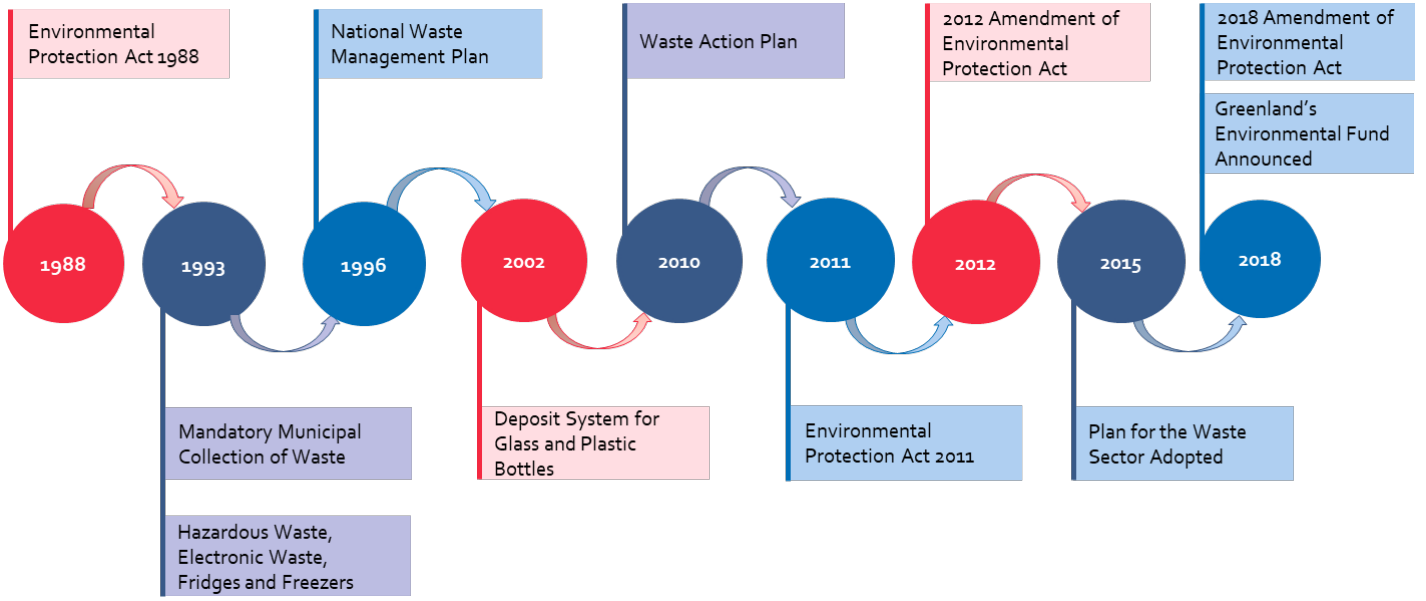
Definition of Municipal Waste

Municipal Waste in Greenland is defined as "mixed waste and separately collected waste from households and other sources where such waste is similar in nature and composition to household waste". This definition resembles that in WFD.

3.5.3 *Policies*

Figure 20 shows the policy timeline for Greenland's policies relating to waste management.

Figure 20: Timeline of Waste Policy in Greenland



Mandatory Municipal Collection of Waste (1993)

The 1993 Mandatory Municipal Collection of waste stated, that waste management in Greenland is a municipal responsibility, although in practice this may have been the case prior to the legislation. Municipalities are responsible for waste from households along with some commercial waste, with the aim of the policy being to reduce the amount of landfilled waste and improve control of small dumps. As such, collections of household waste are made typically once a week, but may be made up to three times a week. Collection covers all waste from households, institutions and commercial premises. The refuse collected is delivered for incineration in six of Greenland's towns, or to local dumps in the smaller settlements.

Waste and recyclable materials can also be taken by the waste producer to a local "receiving station". Such recyclable waste includes wood and metal. Paper and cardboard are collected in a few areas through pilot projects, as discussed in 3.5.2. Data for the time series required for Greenland was unavailable and, as such, it has not been possible to assess the success of this policy.

Hazardous Waste, Electronic Waste, Fridges and Freezers (1993)

Also in 1993, policy was brought in to address hazardous waste, electronic waste, fridges and freezers. This aimed to increase the proportion of hazardous waste that was submitted via receiving facilities, as opposed to via the before mentioned household collection services. Receiving facilities have been established for batteries and WEEE in all cities and the majority of villages. This collected waste is shipped to Denmark for treatment, as the facilities to treat it do not exist in Greenland.

The Waste Action Plan (1996)

Greenland's first waste action plan was introduced in 1996. In accordance with this Waste Action Plan, it is estimated that SEK 230 million of investment (EUR ~ 22 million) was made – installing incineration plants and receiving stations for waste in the six larger cities, and smaller incineration plants in the smaller settlements.

Under this plan, and since the 1993 Act on the Mandatory Municipal Collection of Waste, the costs of waste management in Greenland were financed by annual waste fees, delivery fees, taxes and a small proportion from sources described as "other". In 2004, annual waste fees contributed 28% of the budget for waste management, delivery fees 21%, taxes 45% and "other" sources 6%. All municipalities collected

annual waste fees from households for collection, and some also included businesses in their collection systems.[58]

Information on the current waste action plan is listed under "The Waste Action Plan (2010)".

Deposit System for Glass and Plastic Bottles (2002)

In 2002, Greenland initiated a deposit system covering glass and plastic bottles used for beer and carbonated soft drinks. This followed on from an executive order in the early 1990s on packaging for beer and carbonated soft drinks. The aim of the deposit system was to ensure a high recycling rate for beverage packaging and limit the quantity which is littered. A goal of 90% return was set for these items.

The system is active only in West Greenland and requires that beer and carbonated soft drinks may only be sold and served in refillable packaging complying with requirements in the policy. The policy does not cover other beverages such as drinking water, wine or spirits. The containers collected are refilled and reused after return by the consumer. To this extent, only four specific plastic and glass bottles can be used for sale of beer and soft drinks. Sale of beer and carbonated soft drinks in disposable packaging is prohibited in West Greenland. The return rate for the current system in West Greenland is 98.5%, with the deposit for all bottle types at 2 DKK/piece.

The less densely populated North and East Greenland are not part of the deposit scheme and beverages can be imported in other packaging. This packaging is disposed of in landfills/open dumps, as there are no incinerators in these areas.

The Waste Action Plan (2010)

The current 2010 Waste Action Plan has eight milestones for improved waste disposal and recycling in Greenland. It is made up of a short-term plan which covered the years 2010–2013, and an eight year forward-plan for 2014–2021. One of the milestones in this plan was to reduce waste generation and increase recycling, with the aim to develop recycling schemes for different types of waste and waste fractions. The milestone states:

[58] Naalakkersuisut (2008) *Waste Action Plan 2010-2013, Affaldshandlingsplan 2010–2013* (Pages 48–49) https://naalakkersuisut.gl/~/media/Nanoq/Files/Attached%20Files/Miljoe/affaldshandlingsplan/affalshandlingsplan%20omd%20bilag.pdf

"If it is economically feasible, recycling schemes for different types of waste and waste fractions in major cities should be introduced by 2013 and then in all other cities."

In three of Greenland's five local municipalities, schemes, or pilot schemes, are in place for recycling or reuse of glass, metal, wood, paper and card, food waste and items for direct reuse. Coverage of these schemes (in terms of number of households / citizens) is not clear, neither is the nature of recycling for the materials collected. At a national scale, Greenland has not established the recycling mechanisms equivalent to those required in EU Member States by the EU's Circular Economy Package.

Targets for reception facilities for hazardous waste in all cities have been met: however, establishment of reception facilities in the smaller settlements, as well as controlled dumps and renovation of existing incineration plants, lags behind. As such, Greenland is far from meeting the targets set out in its Waste Action Plan.

A new Waste Action Plan is currently being developed by the Government in partnership with the municipalities, although it is currently unclear when this policy will be published.[59]

Environmental Protection Act (2011)

The 2011 Environmental Protection Act aims to protect the natural environment in Greenland so that development is sustainable, and also applies to landborne marine pollution. The act has six main aims, of which two target resource use and waste management. Aim number five is "limit the use and waste of resources" and aim number six is "promote recycling and reduce waste disposal issues".

Chapter 7 of the Environmental Protection Act addresses waste in detail, containing measures around specific provisions and waste types. One of the measures in the Act relates to the disposal of cars, boats, ships, snowmobiles and other large items, and requires that these are advertised for a minimum of three months before being classed as waste. At that point, it becomes the municipalities' responsibility to oversee their disposal.

The chapter also covers regulation around the import and export of waste. Greenland prohibits the import of waste, unless it is non-hazardous waste for recycling. Given the recycling facilities in Greenland, it seems counter-intuitive to accept waste

[59] Waste - Naalakkersuisut, accessed 15 January 2019, https://naalakkersuisut.gl/en/Naalakkersuisut/Departments/Natur-Miljoe/Miljoe-og-beredskabsafd/Affald

imports at all. There is however a provision for all waste imports to require approval from Naalakkersuisut, Greenland's Environment Agency. In addition, waste exports may only be made from Greenland to countries covered by the Basel Convention on transboundary movements of waste and its disposal.

Section 39 of the act allows the municipal councils to set fees to cover expenses for the planning, establishment, operation, closure, finishing and administration of waste systems, including instructions and guidance for citizens. The fee may also cover sorting, collection and transportation of waste as well as the establishment and operation of companies and facilities for recycling of waste, incineration of waste and disposal.

Other provisions included in the act allow Naalakkersuisut powers to develop future measures. These provisions are broad and cover powers for measures looking at the design of waste regulations, through to product requirements restricting use of certain raw materials or additives which restrict how well products or packaging can be recycled.

On the whole, the Environmental Protection Act creates the space for Greenland to develop its regulation with respect to management of waste. However, the act itself contains few specific measures for waste management in Greenland.

The environmental protection act was updated in 2012, and again in 2018. The 2012 amendment outlined that fines imposed pursuant to the legislation would accrue to the National Treasury. The 2018 amendment adapted the legislation following the closure of KANUKOKA, the national association of Greenland's municipalities.[60]

Plan for the Waste Sector (2015)

Greenland's plan for the waste sector was adopted in 2015 and covers the planned investment in the waste sector over the next ten years. It recognises the challenges to Greenland's waste sector and the issues with current practice in terms of leachate pollution from open dumps, and in open combustion of waste and incineration at low temperatures resulting in air pollution. One of Greenland's particular concerns in this sphere is the emission of dioxins from incinerators which stand high above EU limits, another is that PCB levels higher than recommended by Canadian limits have been detected in the blood of Greenlandic women of childbearing age.

[60] Regelsæt database, accessed 15 January 2019, http://lovgivning.gl/lov?rid=%7bA340FF6B-A55B-4A1C-BC3B-9730B033E53E%7d

The plan for the waste sector lists four fields of action:

- installations for the handling of hazardous waste;
- deposit of collected and untreated sewage into the sea "natrenovationsanlæg";
- establishment of controlled landfills; and
- incinerators.

To enable changes to happen, grants are being made available by Greenland's Environment Agency to make the construction of necessary waste infrastructure possible. These grants will also address social issues in Greenland, as the construction projects aim to reduce unemployment, whilst also providing a solution to environmental and health issues attached to the current methods of waste treatment.

The section of the plan for the waste sector on incinerators highlights the issues with relation to flue gas cleaning. Incineration plants in major cities are equipped with flue gas cleaning systems in the form of electrostatic precipitators, which remove particulates but not dioxins. Dioxins are thought to be an increasing health concern in Greenland, with the smallest dioxin emissions 34 times above the EU limit in small settlement incineration plants, and at the highest 2,200 times as high. In small settlements these are an alternative to burning waste in open dumps.

The plan for the waste sector also highlights the impact that inadequate waste management and sewerage is having on Greenland's valuable tourist industry. It creates a hierarchy of priority places where clean-up efforts will be initially focussed and waste management facilities improved.

The milestones in the plan are as follows:

- by proper handling and disposal of hazardous waste, ensure that the substances from hazardous waste disposed of in a manner which reduces the exposure of the community with respect to PCBs, dioxins, heavy metals, etc;
- controlled design and operation of landfills and proper decommissioning of existing dumps to reduce pollution of the local environment. In Particular this will aim to reduce the leakage of heavy metals, phthalates, PAH 15 and other contaminants into the local environment and the marine environment;

- efforts to improve the management of sewage resulting in both a reduction in unsanitary, unhealthy conditions and the aesthetic and visual pollution of the cliffs and coastline; and
- when renovating the existing combustion facilities, solutions should first address pollutants such as dioxins, heavy metals, particles and others. Similarly, the local odour pollution, dust and smoke should also be reduced considerably. A settlement operation optimization of combustion will correspondingly reduce the above pollutants from internal combustion solutions.

The goals in the plan are split across the different sectors and are as follows:

- a requirement for functioning waste reception facilities for hazardous waste in Greenland's big cities;
- establishment of a container based solution for all medium and small cities by 2016 for hazardous waste;
- a minimum requirement for a controlled environment and approved waste disposal site in each municipality by the end of 2016;
- all dumps in towns and villages to be abandoned or converted to controlled and environmentally approved landfills by the end of 2024;
- evaluation of all existing incinerators in large cities, considering whether it is possible to optimise their operation and prolong the lifespan of existing plants, by the end of 2015;
- by the end of 2016, decision on the new construction of or renovation of existing incinerators;
- emissions of dioxins and heavy metals from incinerators in major cities to meet EU levels by 2024; and
- by 2020, development of environmentally sound waste management plans for combustible waste in settlements. Implementation to start by 2022.

The plan also provides a significant yearly budget for development of pilot projects in waste management. These are granted DKK 1–3 million per annum (EUR ~130,000–400,000) and look to gain experience in waste minimisation, composting, recycling of waste fractions, transport of waste between villages and optimisation of the operating

system. This budget has recently been succeeded by the introduction of Greenland's Environment Fund.[61]

It is hoped that the plan will continue to develop in the future as progress is made towards the goals and milestones outlined and, as such, will provide the foundation for developments in the waste sector for ten years. The plan was developed in close cooperation with the municipalities and affirms that each of the municipalities are also developing their own municipal waste plans which, once published, will contribute to the development of the plan.

Greenland's Environmental Fund (2018)

A recent development linked to the 2015 Plan for the Waste Sector is Parliament Act no 9 of 27 of November 2018 on the Environmental Fund.[62] The law came into force on 1 of January 2019, and established an environmental fund with a distinct budget within the Finance Act.[63] Resources for this fund come from the revenue of environmental taxes imposed on goods or activities with an environmental impact, revenue of environmental taxes designed to promote certain behaviours and grants from Greenland's national budget. The revenue of the fund may be used for the following purposes:

- support for general environmental improvements in the area or activity that has been imposed on an environmental tax;
- supporting the promotion of behaviour of users subject to an environmental tax in order to minimize environmental impact.

[61] Regelsæt database: Inatsisartutlov nr. 9 af 27. november 2018 om Miljøfonden, accessed 21 January 2019, http://lovgivning.gl/lov?rid=%7b72B056D0-4D8E-4918-9370-95511F9CE872%7d

[62] Regelsæt database: Inatsisartutlov nr. 9 af 27. november 2018 om Miljøfonden, accessed 21 January 2019, http://lovgivning.gl/lov?rid=%7b72B056D0-4D8E-4918-9370-95511F9CE872%7d

[63] Grønlands Selvstyre (2018) *Finanslov 2019*, December 2018, https://naalakkersuisut.gl/~/media/Nanoq/Files/Attached%20Files/Finans/DK/Finanslov/2019/FL2019%20%20med%20sidetal%20linket%20indholdsfortegnelse%200g%20underskrift%20%20DK.pdf

Specifically, the Environmental Fund can be used to support activities related to the following tasks:

- establishment or upgrading of incineration plants;
- establishment or upgrading of sewage treatment plants;
- establishment of controlled landfills;
- handling including scrapping or recycling of end-of-life vehicles;
- handling of waste around companies, institutions, homes or in the open country;
- handling and treatment of abandoned vessels;
- handling and treatment of discarded fishing gear and other waste in the sea;
- cleaning of fishing grounds;
- projects to enable or facilitate resource-conscious behaviour of citizens and businesses.

The text of the Act emphasises that municipalities are still expected to contribute to the financing of municipal environmental plants. Further, it states that grants may be awarded for local environmental consultants working with municipalities to implement pilot projects, similar to those under the 2015 Plan for the Waste Sector. These would be delivered in cooperation with the Ministry of Nature, Environment and Research.

Naalakkersuisut are required to publish an annual report on the activities of the Environmental Fund.

3.5.4 Challenges

Significant challenges to improving waste management exist in Greenland, many of them linked to its geographic and climatic nature and some of which are shared with other Nordic countries such as Iceland. For many of the coastal towns and cities, the only link to the capital is via water. Transport to Europe for processing of recyclables involves a 4,000 km journey by ship, and further transport by road. Such transport requirements increase the cost of recycling to the extent that it may not be economically feasible to export recyclables.

However, there is a recognisable opportunity to backhaul recyclable items to Denmark on haulage ships which import goods, as is currently the practice with

hazardous waste. Inevitably there will be a cost associated with this, however, there could be an opportunity to develop producer responsibility schemes which contribute to financing such end of life treatment for products and exports for recycling. This seems like a priority for Greenland given the lack of domestic recycling infrastructure. One specific challenge in this respect is that shipping to Greenland is currently a monopoly of the Royal Arctic Line. As such, any new backhauling policy would have to be facilitated through them. Moreover, such a scheme would likely require development of storage facilities in proximity to the port. Both of these challenges should not prevent Greenland from exploring this option.

Furthermore, existing availability of uncontrolled disposal facilities may act to reduce motivation to recycle, and there are issues of scale. A typical town in Greenland may generate less than 5,000 tonnes of waste annually, and many settlements generate less than 20 tonnes.[64] Such amounts define the requirements for capacity for waste management infrastructure and logistics, and with respect to cost, also limit the technologies which are feasible. This scale issue and the vast expanse of land have resulted in the existing waste management system, with low efficiency, poorly controlled incineration of waste, and large fractions of waste being landfilled.

No economic instruments are in place to discourage the use of landfills. However, a landfill tax as used elsewhere would likely require further infrastructure to allow for the weighing of waste and would present a significant change to Greenland's waste infrastructure. Additionally, due to the local landfill of waste, and difficulties in waste transport the number of weighing facilities could be impractical. Furthermore, winter conditions in Greenland are likely to present an additional challenge to developing such schemes.

At present, the lack of data recorded also means that it would be difficult for Greenland to track their progress towards recycling targets. Focussing on reuse may be a productive direction for Greenland to investigate due to issues with waste management and treatment. For example, schemes using reusable glass bottles for beverages could be expanded to cover all beverages and extended beyond current scope in West Greenland.

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[64] Eisted, R., and Christensen, T. (2013) Environmental assessment of waste management in Greenland: Current practice and potential future developments, *Waste Management & Research, The Journal of the International Solid Wastes and Public Cleansing Association*, ISWA, Vol.31.

It is worth recognising that current waste management practices result in environmental issues beyond failing to achieve recycling rate targets. Waste management via small scale incineration and open pit burning causes direct emissions to the environment in terms of flue gases from the incinerators (especially given limited flue gas cleaning), as well as significant fossil fuel emissions from combustion of plastics. Leachate and gas from open dump landfills is an additional issue. Low levels of emission control from incinerators are a concern in Greenland, although this is something that the government is taking action to tackle.[65,66]

3.6 Iceland

Iceland is a Nordic Island country in the North Atlantic, covering an area of ~100,000 km^2 and with a population of ~330,000 in 2016.[67] The population is concentrated in the greater Reykjavik area, with ~60% of people living there.[68] Iceland experiences harsh weather conditions for a large part of the year and there are relatively long distances both between municipalities and between Iceland and the European market. Faroe Islands and Greenland are Iceland's nearest neighbours. Apart from these countries, Scotland is the nearest European country, 800 km away, and Norway the second nearest, 1,000 km away.[69] In this way, Iceland bears similarity to Greenland, although intra-country transport is more feasible in Iceland than is the case in Greenland.

Iceland is not a member of the EU. However, Iceland is a European Free Trade Agreement (EFTA) member and has signed the agreement on the European Economic Area (EEA). Through this agreement, Iceland has to implement the EU directives relating to the environment.

[65] European Environment Agency (2012) *Waste in Greenland, 2012.*

[66] Naalakkersuisut, *New national solution in the waste area* (2018) https://naalakkersuisut.gl/da/Naalakkersuisut/Nyheder/2018/09/260918-Ny-national-loesning-paa-affaldsomraadet

[67] World Bank, United Nations (2016).

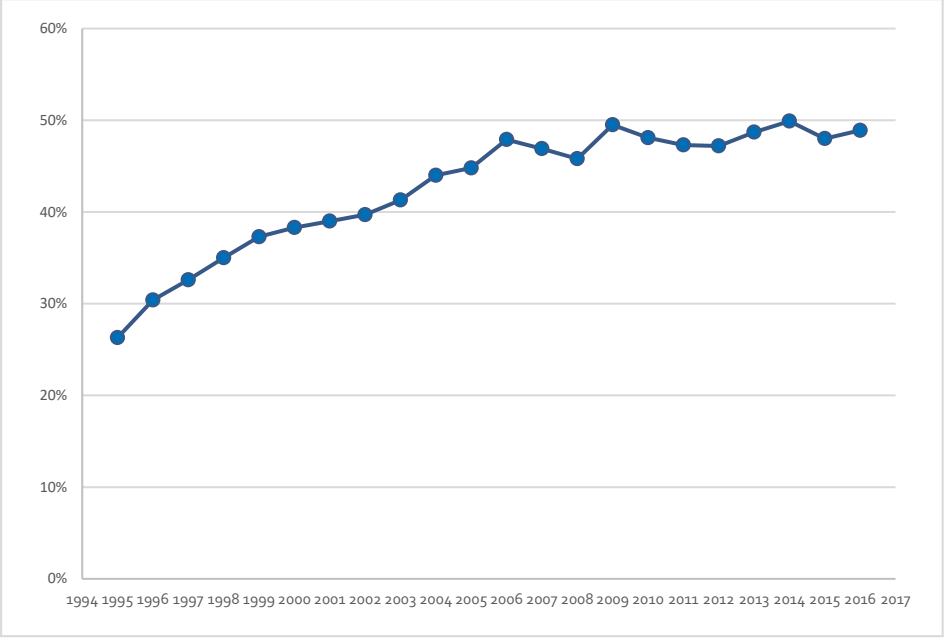
[68] Iceland EPA (2006) *Waste Management in Iceland.*

[69] European Environment Agency (2013) *Municipal Waste Management in Iceland* https://www.eea.europa.eu/data-and-maps/data/external/municipal-waste-management-in-iceland

3.6.1 Current and Historic Trends

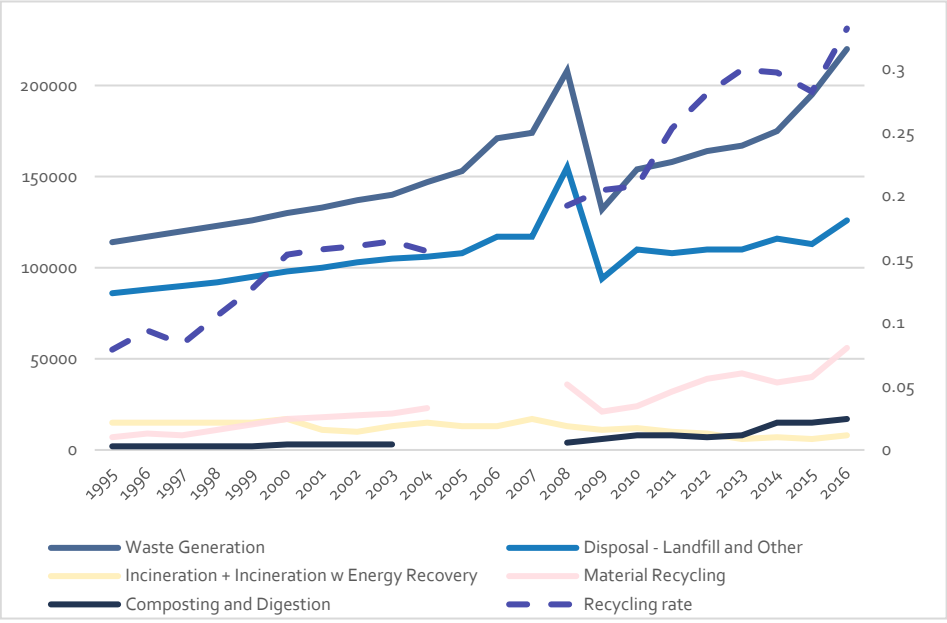
Iceland reported a 33.2% recycling rate for municipal waste in 2016.[70] This has undergone steady increase, more than doubling since 2000, when it stood at 15.4%. Change in recycling rate over time is shown in Figure 21, however data is unavailable for the period 2004–2007 for Iceland. It is notable that Iceland's recycling rate has increased significantly over the time period shown. However, as highlighted by a European Environment Agency report in 2012, Iceland is still below the 50% recycling target for 2020, and increasing the recycling rate at the pace observed over recent years will not be sufficient to see them through to meeting the target by 2020. As such, Iceland will need to consider significant changes in waste management to meet the increased targets discussed in Section 2.

Figure 21: Recycling Rate for Municipal Waste in Iceland (1995–2016)



[70] Eurostat (2016) *Recycling Rate of Municipal Waste*
http://ec.europa.eu/eurostat/tgm/table.do?tab=table&plugin=1&language=en&pcode=sdg_11_60

Figure 22: Treatment Routes for Municipal Waste in Iceland (1995–2016) (tonnes, %)



Iceland adopted the EU definition of municipal waste in 2003 and definitions have been regularly updated in accordance with the EEA agreement. The last update occurred in July 2017, to put into law the EU directive 2010/75/ESB. As such, municipal waste covers household waste, and waste similar in nature and composition to household waste.

Recycling is reported as the quantity collected for recycling. Due to the fact that recycling facilities hardly exist in Iceland, this has been the most feasible measurement to obtain, as recyclables are mainly shipped to nearby countries such as Sweden for processing. This is not in keeping with the new WFD definition and is likely to overestimate recycling, for example for plastics that are separately collected, some are incinerated rather than recycled.[71] Figure 21 details Iceland's reported recycling rate, demonstrating the increase observed in recycling rate since data collection began in 1995. Waste reporting in Statistics Iceland does not allow further detail on quantity of different types of municipal waste recycled since the composition reporting includes all

[71] Ekkirusl *Asked and Answered* https://www.ekkirusl.is/spurt-og-svarad/

commercial and industrial wastes as well as "municipal" and household waste, with household waste making up only 12% of the total waste in Iceland. There is no national waste composition analysis of municipal waste to understand what the "capture rate" of different recyclable materials is at present.

3.6.2 Note on Iceland's Waste Data

Iceland's waste data presents a challenge for analysis due to some required household waste data not being available or the method of data collection or recording changing over the time period analysed, leading to artefacts in the results. As such, municipal waste data which was submitted to Eurostat was used for the analysis for Iceland. Thus, the data for Iceland is different to that for the other countries analysed where household waste data was used and where a greater breakdown of detail was available. This approach was taken as it was felt to yield the most reliable and longest-spanning dataset for the country, from which overall trends and impacts of policies could be observed and analysed.

3.6.3 Approach to Waste Collections

Historically, Iceland relied on open-pit burning for waste management. Since the 1970s, significant change has occurred and progress has been made. Throughout the 1990s, many municipalities replaced the open pits with raised burning-cisterns to prevent waste blowing away, limiting the loss of waste to the environment. However, this treatment of waste results in incineration at low temperatures and release of airborne pollutants. Since 2000, and following the phase out of open-pit burning, landfill has become the most widely used final treatment option in Iceland. Proper landfilling and incineration are still expensive due to the long transport distances between waste generation and treatment sites.[72] The greater Reykjavík area has 6 waste collection facilities, 1 sorting facility and one landfill facility. Anaerobic digestion and composting facilities are being constructed at present. All municipalities tend to have facilities for waste collection, in some cases this will be based on cooperation between multiple municipalities. For example, Sorpa covers around 60% of the Icelandic population,

[72] European Environment Agency (2013) *Municipal Waste Management in Iceland, 2013.*

covering Reykjavík and the surrounding municipalities of Kópavogur, Hafnarfjörður, Garðabær, Seltjarnarnes and Mosfellsbær.

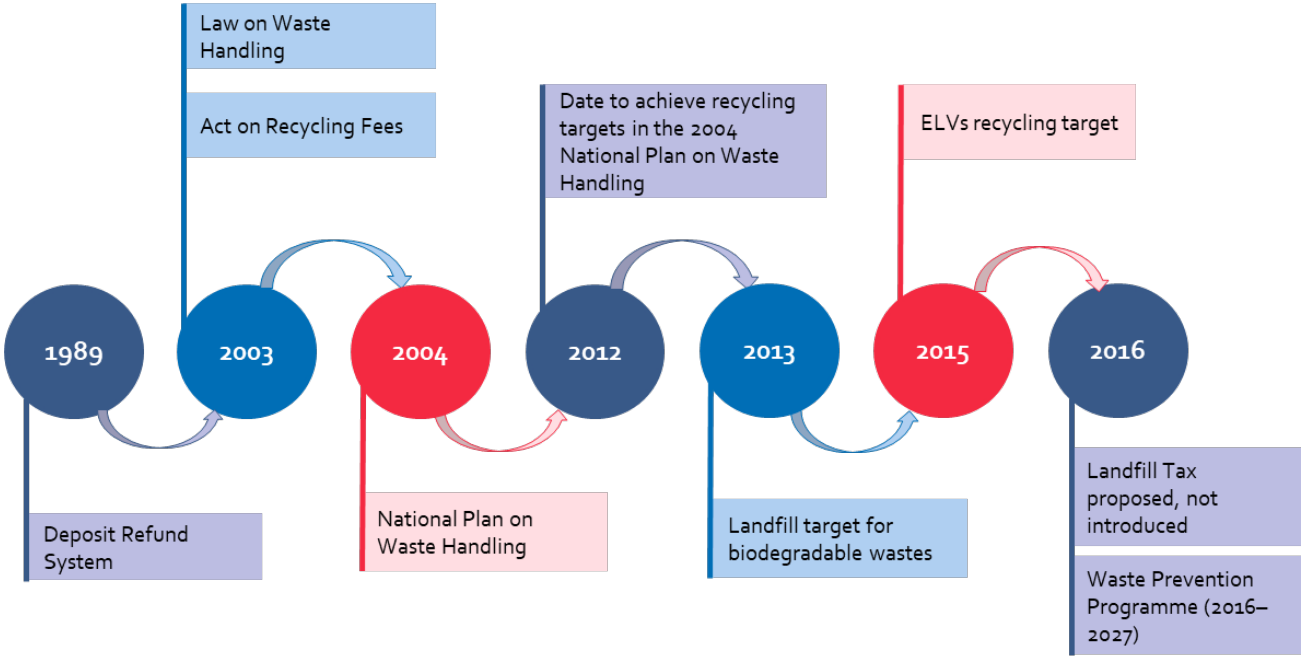
Waste collection and management is the responsibility of the municipality, with households required to sort waste prior to collection. Door-to-door collection for household waste and common recyclables is universal in urban areas and almost all rural areas in Iceland. There are bring-bank recycling facilities in many of the greater-Reykjavík area's municipalities for paper and plastic, and sometimes for clothing (for the Red Cross).

Residual waste is typically collected every 7–10 days and recyclables every 10–14 days, but again this may vary between municipalities. For example, Reykjavik's collection of recyclables is three-weekly. Approaches to collections are known to differ between municipalities depending on the facilities available in their region. There is no specific food or garden waste collection in Iceland. However, individual households may compost and recycle food waste at home and recycling points do collect garden waste.

3.6.4 *Policies*

The timeline for the main policies affecting waste in Iceland is shown in Figure 23.

Figure 23: Waste policy timeline – Iceland



3.6.5 Discussion of Policies

Deposit Refund System (1989)

Iceland has had a deposit refund system (DRS) in place since 1989, covering plastic (predominantly PET), aluminium and glass. The scheme covers all ready to drink beverages, wine and liquor and excludes milk and milk products. The deposit value is currently ISK 16, or EUR 0.12, per container. In addition to the deposit paid by consumers, a fee is paid by importers of disposable drink containers, and by domestic producers of drinks containers for each unit placed on the market (effectively a beverage packaging tax). The DRS creates a financial incentive for the recycling of disposable drinks containers.

In 2014, the DRS reported a total return rate of 90%, with 90% of cans returned, 87% of PET bottles and 83% of glass bottles.[73] However, this does not directly equate to recycling rates for these items as glass collected in Iceland is landfilled. It is thought that return rates are limited by tourist consumption, and lack of understanding of the system, which leads to unreturned containers and unredeemed deposits. Despite this, the return rates achieved are high.

The materials collected from the DRS present an opportunity for Iceland to increase their recycling rate. With the status quo as glass being collected but not recycled, it seems as though forming arrangements to export and recycle glass would be a straightforward way by which Iceland could make improvement to recycling rate. Single stream material is collected via the DRS and presently not recycled due it not being profitable to do so.

Act on Recycling Fees (2003)

The Act on Recycling Fees was announced in 2002 and implemented in 2003. The Act charged the Icelandic Recycling Fund with creating economic conditions conducive to reuse and recovery, reducing the volume of waste to final disposal and ensuring proper disposal of hazardous substances. The fund works as an EPR scheme, applying economic incentives to establish arrangements for waste processing. The fund contracts out waste processing and uses the recycling fee to pay the cost of this.

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[73] Reloop, and CM Consulting (2018) *Deposit Systems for One Way Beverage Containers: A Global Overview, 2018*, https://reloopplatform.eu/wp-content/uploads/2018/05/BOOK-Deposit-Global-27-APR2018.pdf

Recycling fees are imposed on importers and producers to cover the costs of disposal and apply to both imported and domestically produced goods. In general, the fee is set on the basis of weight, however for certain items like vehicles, the charge is related to the number of units.

In total, the fee covers the following categories: motor vehicle waste, paper packaging, plastic packaging, tyres, bale plastic, hazardous waste and WEEE. The level of fee ranges from ISK 3 – 0.024 EUR/kg to ISK 900 – 7.24 EUR/kg depending on the waste category. For cardboard and paperboard, the processing fee is set at 15 ISK/kg – 0.12 EUR/kg, and for plastic packaging the fee charged is 16 ISK/kg or 0.13 EUR/kg. The fee is charged whether it is for packaging alone or for goods imported to Iceland in packaging.

Law on Waste Handling (2003)

Iceland's 2003 Law on Waste Handling aims to ensure that waste management and handling is conducted in a way which minimises harm to human and animal health, and the environment. It also aims to ensure that waste management is efficient, waste treatment is appropriate and resources are used sustainably to reduce waste, as well as ensuring that the Polluter Pays principle is upheld in waste treatment.

The policy is a general act which provides a framework for public policy regarding waste treatment. It distributes responsibility between Iceland's environment agency and the municipalities, by providing a framework for the development of regional policies.

The law also requires Umhverfisstofnun (the Environment Agency) to develop a 12 year plan on waste handling (National Plan on Waste Handling), which includes time-based targets for recycling. The first National Plan on Waste Handling was produced in 2004 and covers the period 2004–2016. Most municipalities have implemented a regional plan based on the national plan.

National Plan on Waste Handling (2004–2016, 2016–2028)

The first National Plan on Waste Handling aimed to increase recycling and reduce waste generation and covered the 12-year period from 2004–2016. The second version of the National Plan on Waste Handling covers the period from 2016–2028. The plan provides an overview of the status of waste management in Iceland and the development of different treatment methods and facilities. Time-based targets are set concerning recycling rates and waste management methods. Specific goals stipulated in the regulations are listed in Table 9, in chronological order. The list includes future measures which Iceland has planned to introduce under the second National Plan on Waste Handling.

Table 9: Measures in Iceland's National Plan on Waste Handling

Item/Waste type	Date	Target
Packaging	January 2012	60% of all packaging waste to be reused or incinerated with energy recovery
Glass packaging	January 2012	60% recycling by weight
Paper and cardboard packaging	January 2012	60% recycling by weight
Metal packaging	January 2012	50% recycling by weight
Plastic packaging	January 2012	22.5% recycling by weight
Batteries and accumulators	September 2012	25% collection
Biodegradable wastes	July 2013	Landfill not to exceed 50% of the total amount of biodegradable waste generated in 1995 (120,000 tonnes)
End of life vehicles (ELVs)	January 2015	95% reuse and recycling, or 85% based on average weight
Separate collection	January 2015	Paper, metals, plastic and glass will be collected separately
Construction and demolition waste	January 2015	At least 60% of construction and demolition waste shall be handled and sorted in a way that enables reuse
Disposable plastic bags	January 2015	Efforts to be made to discourage shops for continuing to use plastic carrier bags and stakeholders will be consulted regarding a fee on such bags, or other economic instruments aimed at limiting their use
EPR extension	July 2015	EPR expanded to cover more product categories and establishment of a system to secure implementation
Landfill target	January 2016	The percentage of landfill of total waste generated shall not exceed 25%
Introduction of a Landfill Tax	Scheduled for January 2016 but was not introduced	Level not detailed

Item/Waste type	Date	Target
Future Targets		
Landfill of all wastes	December 2020	Maximum 15% of all waste landfilled
Construction and demolition waste	January 2020	70% of C&D waste to be reused
Landfill restriction – biodegradable waste	July 2020	Biodegradable waste shall not exceed 35% of the total amount of 1995 levels, maximum of 84,000 tonnes
Recycling targets	December 2020	50% of plastic, glass, paper, cardboard and metals shall be prepared for reuse or recycled
Landfill restriction	December 2020	Total waste landfilled must not exceed 15%
Landfill ban – biodegradable waste	January 2021	Ban for landfill of biodegradable waste
Batteries and accumulators	September 2024	85% minimum collection of batteries and accumulators
Landfill of all wastes	December 2025	Maximum 5% of all wastes landfills

Alongside the specific targets for materials and waste treatment streams, Iceland's national plan on waste handling also includes more general commitments to changing waste management. Measures included in the plan are described below:

- publication and regular updates of environmental indicators that reflect the success of reaching the targets in the national plans, either on a separate website or as a supplement to Umhverfisstofnun's sustainability indicators;
- total revision of the waste legislation with the aim of removing barriers to recycling in Iceland;
- a waste collection scheme for each home and summer house for most waste categories;
- efforts to be made to encourage shops to discontinue disposable plastic carrier bags. Stakeholders will be consulted regarding imposition of a special fee on such bags or other economic instruments to limit their use;
- collection for carcasses will be established;

- authorities shall create conditions for at least one incinerator for waste (i.e. authorities do not have to build an incinerator themselves); and
- establishment of extended producer responsibility in more product categories and establishment of a system to secure implementation.

Waste Prevention Programme (2016–2027) "United Against Waste – General Policy on Waste Prevention 2016–2027"

Iceland has introduced a waste prevention programme in line with the WFD, Article 29 of which requires Member States to introduce waste prevention programmes.

The overall objective of the Icelandic waste prevention policy is to improve the economy through improving resource utilization, efficiency and education to prevent waste. The sub-objectives are listed as follows:

- reduce waste generation;
- reduce greenhouse gas emissions;
- improve the use of resources, e.g. with a focus on green innovation;
- reduce the use of raw materials parallel to less environmental impacts; and
- reduce the distribution of materials that are harmful to health and environment. [74]

The waste prevention programme covers waste from households, amongst a number of other sectors. The waste prevention programme does not set quantitative targets, instead introducing measures looking to achieve waste prevention. These measures include a number around addressing the issue of food waste – both from households and from industry. A list of measures in the waste prevention programme is given below:

- Installing a system where food that has passed its best-before date can be sold at a reduced price;
- Increasing the categories of beverage containers that carry a refundable deposit;
- Educating the public on: more efficient purchasing, how to handle food, assess whether food is edible, the use of labels, the best way to use leftovers;

[74] European Environment Agency (2016) *Iceland Waste Prevention Fact Sheet, 2016*.

- Educating the public on reducing water consumption from disposable packaging;
- Improving ease of access for delivering beverage packaging for recycling;
- Increasing support for home composting;
- Cooperating with restaurants and other caterers to reduce food waste;
- Partnering with manufacturers and vendors to reduce the use of plastic packaging and unnecessary packaging and promoting designs which take account of waste prevention;
- Partnering with manufacturers and vendors to reduce the use of plastic carrier bags;
- Partnering with vendors, in order to increase the market share of ecolabelled textiles or textiles that contain a minimal amount of harmful substances;
- Supporting the reuse of old clothes;
- Reducing the use of disposable food containers;
- Eliminating the use of plastics which are difficult or impossible to recycle;
- Measures for plastics other than packaging and carrier bags, e.g. the use of microplastics in cosmetics;
- Finding more ways to create products from animal-by-products which are sent for disposal;
- Eliminating the legal barriers that hinder the use of animal by-products;
- Cooperation to reduce the use of beverage packaging produced from materials that cannot be recycled; and
- Working with beverage manufacturers to reduce of the use of single-use packaging.

There are indicators proposed for assessing progress through these measures which look at specific fields which they look to address. These are food waste, plastic waste, animal by products and beverage packaging. The indicators proposed include metrics such as the volume of food waste collected per year, and average food consumption per household in Iceland for food waste. For beverage packaging, example indicators are the proportion of beverage packaging for which consumers can receive a deposit,

and the proportion of deposit covered packaging which is reusable. These indicators will be collated in a mid-term review of the waste prevention programme in 2022.[75]

3.6.6 Challenges

Of all the Nordic Countries Iceland has seen some of the biggest improvements in recycling rate in recent years as it established a waste management system. Significant progress has been made since Iceland joined the European Economic Area in 1994 and became obliged to implement EU waste management legislation, including phasing out the environmentally damaging practice of open pit burning.

One of the major challenges to Iceland's waste management is the lack of domestic waste treatment facilities, and the high cost of appropriate waste management due to geographic and climatic conditions. The small population is considered insufficient to warrant development of domestic facilities so recyclables are exported. Plastics are shipped to Sweden, where they are sorted and then shipped onwards for recycling. Paper is shipped to the Netherlands where it is sorted further and then shipped onto other destinations. Metals are sorted within Iceland, but are then shipped to other countries for recycling. No domestic facilities for recycling of glass exist, and due to its low value, it is landfilled instead of being shipped abroad for recycling. The landfill tax, which had been considered for introduction in 2016, would have improved the economics of recycling relative to landfilling. Recyclable materials are only shipped out of Iceland from two ports, requiring transport from Iceland's smaller towns and villages. Recycling performance is lower in these regions, outside of the capital area. At present there is no food waste or garden waste collections from households in the greater Reykjavik area with some individual households composting.

Additionally, the Icelandic Audit Office recently pointed out that monitoring is lacking around ensuring the municipalities fulfil their duty to make, and introduce, zoning plans, designed to improve waste management. Equally, there is no monitoring in place to ensure such plans are followed where they do exist. A recommendation has been made to put such monitoring in place.[76]

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[75] European Environment Agency (2016) *Iceland Waste Prevention Fact Sheet, 2016*.
[76] *Half of Household Waste in Landfills*, Iceland Review, accessed 13 June 2018, http://icelandreview.com/news/2016/03/09/half-household-waste-landfills

An additional challenge for Iceland is that the cost of electricity is low. Due to existence of a range of renewable sources such as geothermal energy, energy recovery from waste and heat and energy from anaerobic digestion is less competitive. This has further contributed to heavy usage of landfills in waste management, and use of incineration without energy recovery. However, gas produced from waste management has been used in vehicles since 2000 and four gas stations in Iceland provide methane. Between 2009 and 2017, 1,333 new methane cars were registered in Iceland but they only use 6–8% of the supply of methane.

3.6.7 Notable Omissions

Iceland does not have a landfill tax, the Icelandic Government having decided not to introduce one. This is due to the view of landfill taxes, in Iceland, as increasing the overall cost of waste treatment and not influencing prevention, reuse, recycling and recovery of waste generated in the country. The law on Recycling Fees (2002) was instead passed.

However, in the National Plan on Waste Handling (2004–2016), Iceland identified a need to develop a landfill tax and planned to introduce one in 2016. Whilst planned, this tax has not been implemented and is something which Iceland could still consider introducing. Equally, Iceland does not have an incineration tax in place.

As already mentioned, measures to monitor the performance of Iceland's municipalities are lacking, as are measures to ensure that the municipalities are fulfilling their statutory requirements. These are additional areas where policy could be used to improve Iceland's waste management performance.

At present, household biowaste is not collected separately in the greater Reykjavik area and goes with other mixed household waste into landfill. There is, however, a collection of household biowaste in other places of the country, for example in Akureyri, which is an urban area in the north of Iceland, where around 20,000 people are living. With future targets relating to a cap on the percentage of biowaste landfilled, separate collections of household food and garden waste should be investigated. Treatment could be via anaerobic digestion collocated with composting (for garden waste). This would require some consideration as to how the digestate would be used in Iceland.

3.7 Norway

Norway comprises the Western part of the Scandinavian Peninsula. It has a population of 5.3 million (January 2017). Norway is not an EU Member State but is closely associated with the Union through its membership of the EEA, and through having been a founding member of the EFTA.

3.7.1 Current and Historic trends

In Norway, only household waste and industrial waste are clearly defined. Municipal waste is considered to be the result of "business activity" and thus categorized as industrial waste. This applies to waste from municipal institutions and waste similar to household waste from restaurants etc. Norway is, however, required to report municipal waste to Eurostat, and that is reported as household waste and waste from the "service industry". Household waste is exclusively waste that is produced by householders, and comes from residential premises.

A different definition has previously been used in Norway, having been changed in 2004. Previously, waste was defined into two categories; as consumption waste or production waste. Under this previous classification, consumption waste was defined as household waste and waste similar to household waste in composition and quantity. This definition is similar to the current EU definition of municipal waste. Recycling in Norway is measured as the amount collected for recycling.

In 2017 Norway's waste generation per capita stood at 428 kg.[77] Figure 24 details the composition of household waste in Norway in 2017, and Figure 26 shows the available data on household waste arisings and treatment route.

[77] https://www.ssb.no/en/natur-og-miljo/statistikker/avfkomm/aar

Figure 24: Residual Waste Composition Analysis (Oslo)

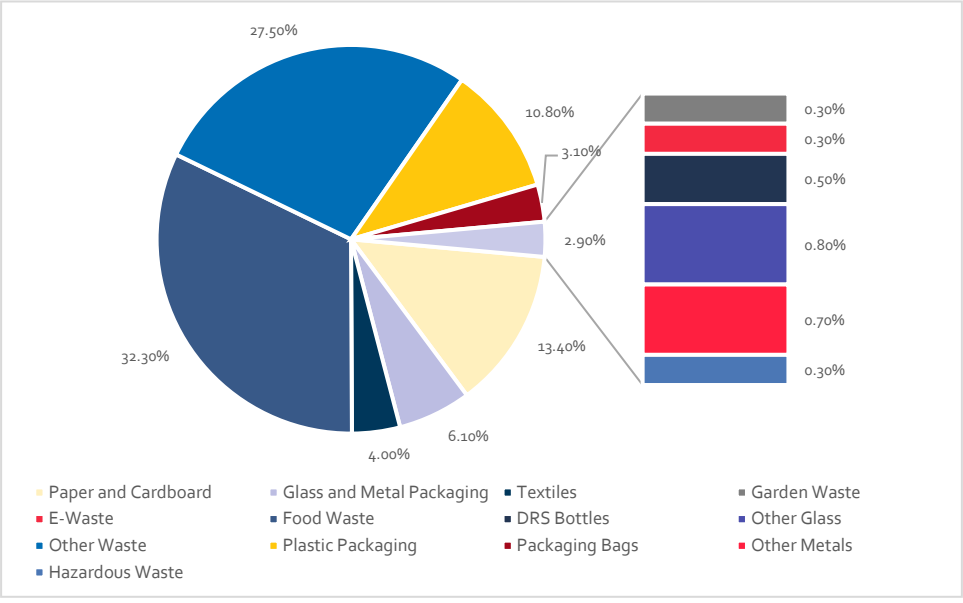


Figure 25: Composition of Household Waste in Norway (2017)

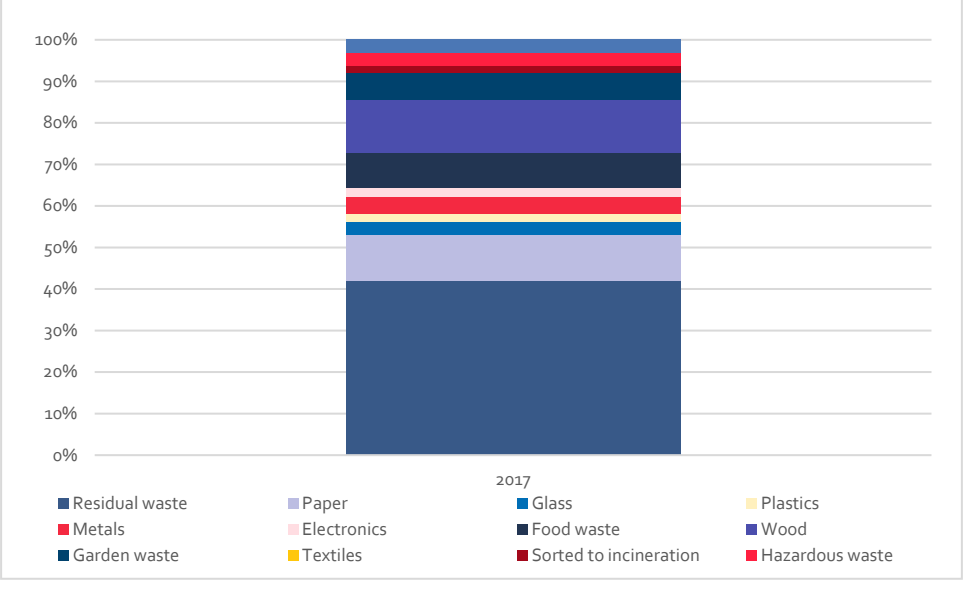
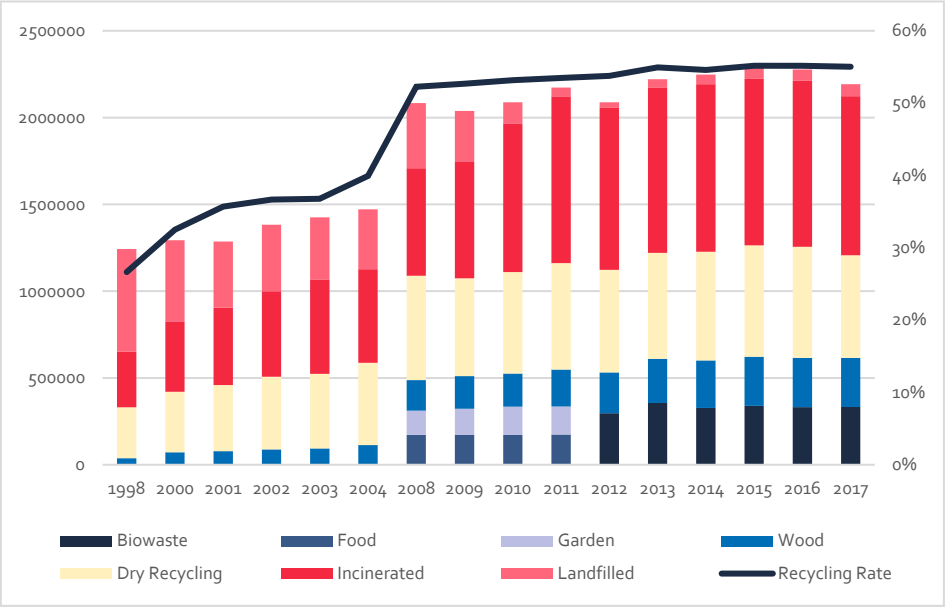


Figure 26: Household Waste Arisings in Norway by Treatment Route and Recycling Rate



Note: Excludes years between 2004–2008 where detailed data was not available.

Figure 26 shows Norway's household waste arisings between 1998–2017 by the treatment route and recycling rate. It is worth noting that there is no data shown for the years between 2004 and 2008 as a detailed breakdown for household waste was not available for these years. Additionally, it is worth noting that reporting of food and garden waste changes in 2012 to be reported as a combined "biowaste" figure. Notably, landfill of household waste has declined significantly since the introduction of the landfill ban on biodegradable waste in 2009. The total waste generation and recycling rate of waste have remained relatively unchanged since 2008.

3.7.2 Approach to Waste Collections

The pollution act states that every municipality needs to offer a system for collection of waste from households. Each municipality chooses their own type of collection system and which waste fractions are collected. As such, the collection systems and waste fractions which can be collected vary between municipalities. Overall, coverage with recycling collections is high and a range of recyclable fractions can be collected. 70% of municipalities offer separate collection of biowaste, 87% have separate collection of plastic packaging and 98% have collection of paper packaging. Method provision of these different systems varies. Food waste collections are door-to-door. Plastics are mostly collected door-to-door, with some bring systems in place. Paper is also collected via a door-to-door system almost ubiquitously. Whilst metal and glass have been collected via bring banks in the past, door-to-door collections are becoming more common across Norway due to them reportedly achieving much better rates of collection. Residual waste is collected door-to-door across Norway.

There are notable regional differences in the recycling rates achieved, these can mostly be explained by the accessibility to food waste collections. Whilst the Norwegian Environment Agency proposed mandatory sorting of food waste (for private households and corporations) in October 2018,[78,79] current practice is determined by the municipality. In 2015, SSB reported that 120 (of 433) municipalities were incinerating food waste along with mixed waste.[80] There are some different approaches to food waste collection in Norway. The City of Oslo in 2012 made source sorting of food waste mandatory moving towards 50% recycling by 2018 using an OptiBag system, as discussed in Section 5.3.1. Whilst this is increasing their food waste recycling it does not directly meet the WFD separate collection requirement, relying instead on a derogation to the requirement to meet it. In Longyearbyen in Svalbard food waste disposal facilities are present in every household.[83]

[78] Lindahl, H. (2016). *Miljø- og Etikkonsekvenser av Norsk Matsvinn*. [online] Oslo: The Future in Our Hands, pp. 1-5. Available at: https://www.framtiden.no/201701247097/rapporter/klima/miljo-ogetikkonsekvenser-av-norsk-matsvinn.html [Accessed 10 Jun. 2018].

[79] *Mat- og plastavfall må kildesorteres bedre*, accessed 4 January 2019, http://www.miljodirektoratet.no/no/Nyheter/Nyheter/2018/Oktober-2018/Mat--og-plastavfall-ma-kildesorteres-bedre/

[80] https://www.ssb.no/en/natur-og-miljo/statistikker/avfkomm/aar/2015-07-07

Pay as you throw systems are not common in Norway, with two schemes in the country at present. In these systems, residents are charged based on whether they place the residual waste container out for collection rather than on the weight of the container. This simplifies the administration of the system, and allows householders to easily monitor and look to reduce their residual waste generation as the system only charges for residual waste. Collection of recyclable streams is free. In addition to these two pay as you throw schemes, a number of municipalities also have systems where residents can choose the size of their bin.

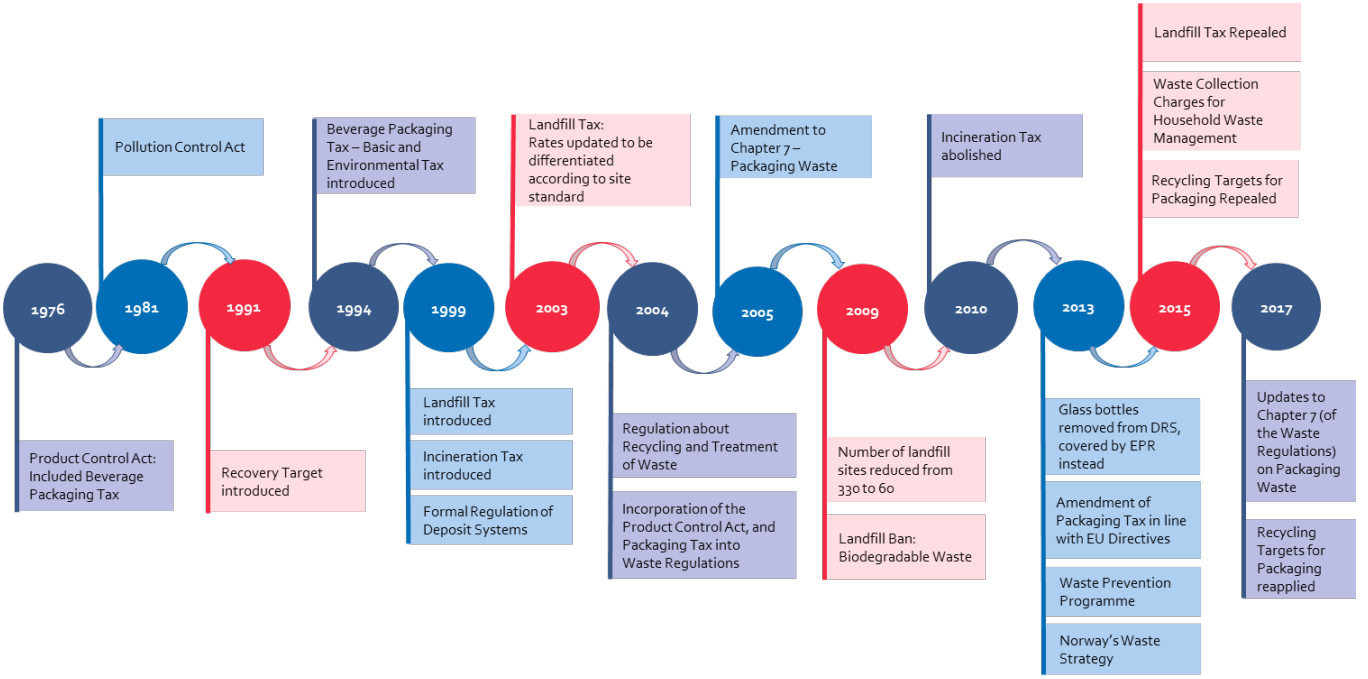
Weekly collection of waste is most common in Norway, although in some rural municipalities it may be less frequent than this. Food waste collections, where present, are mostly on a weekly basis. Collection of paper, plastics, glass and metals is usually monthly.

Finally, there is a requirement in place for sorting WEEE and for sorting hazardous waste in Norway and separate services for receiving these waste fractions are available. A proposal has been submitted for regulation on a separate sorting requirement for biowaste and plastic waste but this is not in place yet.

3.7.3 Policies

Figure 27 shows the development of Norway's waste policy over time. The 2004 introduction of Norway's waste regulations was the most significant development with chapters covering numerous aspects of waste management. These are discussed in more detail in the following sections.

Figure 27: Waste Policy Timeline – Norway



Product Control Act (1976)

The product control act of 1976 forms the legal basis for regulations around packaging and refund systems. When first introduced it set up a tax for beverage packaging. Formal regulation of deposit systems was included under it in 1999, and it was later incorporated into the waste regulations (2004) as chapter six. Full discussion is incorporated in the section on the waste regulations.

Protection against Pollution and Waste (The Pollution Control Act, 1981)

The Pollution Control Act aimed to protect Norway's environment against contamination and reduce existing damage by decreasing the quantities of waste produced, and promoting better treatment of waste. The policy aimed to ensure that the quality of the environment was kept satisfactory and that pollution and waste did not result in damage to human health, did not have adverse effects on welfare and did not damage the natural environment and its capacity for self-renewal. Any operator of a facility treating or storing waste that can cause pollution or appearing harmful must have the relevant permissions, the permissions include specific conditions being stated.

The policy provided a definition of waste and of different waste types such as household waste. Household waste is defined as waste from private households, including large objects such as furniture. Industrial waste is defined as that arising from public and private enterprises and institutions. The policy also granted the pollution control authority the power to regulate the recovery or treatment of waste, allowing it to make decisions around reuse, recycling, energy recovery, collection storage and sorting and the development of binding goals.

Further, this policy also described requirements for facilities to treat waste and the responsibility of the municipalities for monitoring and collection of waste. It allowed municipalities to determine a fee to cover the costs associated with the waste sector, and further encouraged them to differentiate this fee where it may contribute to waste reduction and promote recovery. Responsibilities for provision of bins, emptying and management of roadside litter are also covered in the act.

Recovery Target (1991)

In 1991, Norway introduced a recovery target for 80% of municipal waste.[81] This target was later replaced, in the 2016 budget, by a target to decouple growth in waste generation from economic growth – the Ministry of Climate and Environment (KLD) stating that:

> "The growth in waste shall be significantly lower than the economic growth and the resources in waste shall be used as well as possible through recycling and energy recovery."[82]

A new target around waste treatment and generation will be proposed for Norway in 2019.

Beverage Packaging Tax (1994)

Norway has a packaging tax in place, which was first introduced under the Product Control Act of 1976 and which applies to beverage packaging only. In 1994, updates were made to the beverage packaging tax. From 1994, it consisted of two types of tax – a basic tax and an environmental tax. The basic rate of tax is payable for all beverage containers which cannot be reused, whereas the environmental tax is based on the return rate achieved for the packaging and hence encourages achievement of higher return rates. The tax is linked to the EPR schemes in Norway and to the deposit refund system. Due to the high rates of return achieved for containers in the deposit system, a very small amount of tax linked to return rate is payable. For containers with a return rate >95%, no tax based on return rate is payable.[83]

The tax rates charged are further levied by material, and in 2015 they were as follows:

- Environmental tax:
  - Glass and metal – NOK 5.79 per unit/EUR 0.61;
  - Plastic – NOK 3.50 per unit/EUR 0.37;
  - Cardboard – NOK 1.43 per unit/EUR 0.15.
- Basic Tax (2018):
  - Basic tax on all single-use packaging – NOK 1.19 per unit/EUR 0.12.

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[81] Norway – *White Paper on Waste* No.44 (1991–1992).

[82] *Regjeringen senker ambisjonene for gjenvinning | Avfall Norge*, accessed 15 January 2019, http://kurs.avfallnorge.no/Nyheter.cfm?pArticleId=41092&pArticleCollectionId=2556

[83] *Beverage packaging*, accessed 13 November 2018, /en/business-and-organisation/vat-and-duties/excise-duties/about-the-excise-duties/beverage-packaging/

A small subset of products are exempt from the environmental and basic taxes. Beverages in powder form and breast milk substitutes are exempt from the environmental tax. No basic tax is levied on milk and milk products, beverages made from cocoa and chocolate and concentrates thereof, products in powder form, cereal and soya based milk substitutes, breast milk substitutes.

Formal Regulation of Deposit Systems (1999)

Norway has a long history of informal deposit return systems having been first introduced by breweries around 1900. These systems developed until the Product Control Act (1976) which saw the first formalisation of beverage packaging regulation through introduction of packaging taxes. In 1999 the deposit system was formally regulated in Norway.

Landfill Tax 1999–2015

A landfill tax was introduced in Norway in 1999. It was repealed in 2015.[84] In 2003, the landfill tax was updated and rates were differentiated according to the environmental standard of the landfill site to which the waste was delivered. The highest rate of landfill tax was applied to those sites not fulfilling requirements with respect to site linings. Those not meeting requirements were closed by July 2009 and since, all landfills in Norway are classified as high standard sites. The Norwegian landfill tax levels for 2000–2015 are shown in Table 10.

[84] CEWEP (2017) *Landfill Taxes and Bans Overview, 2017*, http://www.cewep.eu/wp-content/uploads/2017/12/Landfill-taxes-and-bans-overview.pdf

Table 10: Norwegian Landfill Tax in EUR/tonne of waste 2000–2015[85]

	2000	2002	2003	2004	2005	2007	2009	2010	2015
Landfill – all	37	43	41						
Landfill – High site standard			53	48	50	53			
Landfill – Low site standard				62	65	69			
All Landfill							46.8	29	31
Landfill of biodegradable waste								47	

The landfill tax and closure of sites not meeting required standards has had an important impact on Norway's waste management overall. The number of landfills decreased from 330 in 1992, down to 60 in 2012, with municipalities cooperating over the use of landfills instead of having individual facilities.

The introduction of the landfill tax had a stimulating effect on the recycling industry in Norway and the amount of household waste landfilled declined in response to its introduction. In 1998 600,000 tonnes of household waste was landfilled, decreasing to 125,000 tonnes in 2010.[86]

In 2009, the landfill ban on biodegradable waste was introduced. After this, a new rate was charged for waste to landfill, with a separate and higher charge for biodegradable waste which was landfilled despite the ban. Revenue from the landfill tax in Norway goes into the general state budget.

[85] European Topic Centre on Sustainable Consumption and Production (2012) *Overview of the Use of Landfill Taxes in Europe, Report for European Environment Agency*, April 2012, http://scp.eionet.europa.eu/publications/WP2012_1/wp/WP2012_1

[86] European Topic Centre on Sustainable Consumption and Production (2012) *Overview of the Use of Landfill Taxes in Europe, Report for European Environment Agency*, April 2012, http://scp.eionet.europa.eu/publications/WP2012_1/wp/WP2012_1

Incineration Tax 1999–2010

Norway had a tax on the incineration of waste. It was introduced in 1999 and abolished in October 2010. The tax was abolished largely due to the fact that Sweden abolished its incineration tax – creating unfair competition for the Norwegian incineration plants. The incineration tax was linked to the emissions of pollutants from plants, internalising the environmental costs of combustion. The level of tax on waste incineration, is estimated to have been between 720–1,060 NOK/tonne in 2005, or approximately 75–110 EUR/tonne.

Regulation about Recycling and Treatment of Waste (Waste Regulations, 2004)

The Norwegian Waste Regulations, implemented in 2004, contained chapters regarding the treatment of different waste streams and requirements for recycling. Key chapters are discussed below.

Chapter 1 – Discarded Electrical and Electronic Products[87]

This chapter looked to prevent environmental and health issues linked to waste electrical and electronic equipment. It laid out requirements for the reception, collection, recycling and other treatment of electrical and electronic waste. Distributors are required to receive household WEEE free of charge from shops or other collection points. Municipalities are also required to ensure that there are sufficient reception facilities for WEEE, and accept this waste free of charge.

Producer responsibility is achieved through requiring producers to fund the collection, sorting and treatment of WEEE through membership of a collectively-, or individually-, funded return company. The regulation sets out recycling targets which must be met by the return companies which are listed for each product category in Table 11.

[87] Forskrift om gjenvinning og behandling av avfall (avfallsforskriften) - Kapittel 1. *Kasserte elektriske og elektroniske produkter - Lovdata*, accessed 15 November 2018, https://lovdata.no/dokument/SF/forskrift/2004-06-01-930/KAPITTEL_1#KAPITTEL_1

Table 11: Recycling targets for WEEE types

Product Type	Minimum Recycling %	Minimum % prepared for reuse or material recycling
Large household equipment	85%	80%
Small household equipment	75%	55%
Data processing, telecommunications and office equipment	80%	70%
Audio and video equipment and solar panels	80%	70%
Lighting equipment	75%	55%
Light sources		80%
Electric and electronic tools	75%	55%
Toys, leisure and sports equipment	75%	55%
Monitoring and control instruments	75%	55%
Vending machines	85%	80%

Chapter 3 – Discarded Batteries[88]

This chapter sets out requirements for the collection, receipt, processing and recycling of discarded batteries. It requires the distributor to accept returned batteries free of charge from shops or similar facilities. It also places responsibility on the importers and manufacturers of batteries to work with an approved return company to provide for a collection service. The regulation sets a requirement for 95% collection of the total quantity imported and produced for lead and industrial batteries. For portable batteries, 30% collection of a member's total import and production quantity is required.

Chapter 6 – Return Systems for Packaging for Beverages[89]

The product control act of 1976 set up return systems for beverage packaging, and was updated in 1999 to include the formal regulation of deposit and return systems. It was later incorporated into the waste regulations (2004) as chapter six. It addresses beverage packaging, looking to contribute to efficient return systems for the packaging of beverages, and helping prevent waste from such packaging.

[88] Forskrift om gjenvinning og behandling av avfall (avfallsforskriften) - Kapittel 3. *Kasserte batterier - Lovdata*, accessed 15 November 2018, https://lovdata.no/dokument/SF/forskrift/2004-06-01-930/KAPITTEL_3#KAPITTEL_3

[89] Forskrift om gjenvinning og behandling av avfall (avfallsforskriften) - Kapittel 6. *Retursystemer for emballasje til drikkevarer - Lovdata*, accessed 15 November 2018, https://lovdata.no/dokument/SF/forskrift/2004-06-01-930/KAPITTEL_6#KAPITTEL_6

A deposit return system for beverage packaging is set up, including fees to be paid between manufacturers and retailers. The legislation distinguishes rates for containers based on their size with one rate for containers >500ml, and another for those <500ml. As such, no distinction in deposit level is made by material. The current levels are shown in Table 12.

Currently, the system covers plastic bottles (predominantly PET) and metal cans. It excludes milk products, fruit and vegetable juices, dietetic products and products exclusively for infants. Originally, the deposit system also covered glass bottles, however, these were removed in 2013 and their collection instead was addressed via an EPR scheme. This was due to the use of glass decreasing.

The individual producer or importer of beverages can establish and administer, or join, a return system for the packaging. The return system is expected to achieve a minimum 25% return, with the packaging recycled in an "environmentally proper" way. The legislation also regulates deposit rates. Return systems based on energy utilization are only approved if reuse or recycling is not technically, environmentally or economically feasible. According to the 2018 Reloop report, total return rates for the system in 2016 stood at 95.7% for cans, and 88.2% for PET bottles.[90]

The legislation also puts other important requirements in place, such as requiring labelling of packaging not previously covered in a deposit system to be updated prior to incorporation. The labelling should make it clear that the packaging can be returned for a full refund of the deposit. The legislation also sets out the requirement for places of sale to accept return of beverage packaging included in the deposit scheme: this applies both to packaging which is returned for reuse and that for recycling. Secondary packaging may also be reused for return of the packaging to manufacturers.

The act allows the environment agency in Norway to prohibit the use of primary packaging that prevents the appropriate implementation of established deposit schemes. Further, it also allows that if the return type of a certain kind of beverage packaging is deemed to be too low, then a return system may apply to the Environmental Directorate to introduce a higher rate of deposit. In this instance the Environmental Directorate in Norway has the capacity to determine separate deposit levels for individual beverage container types.

[90] Reloop, and CM Consulting (2018) *Deposit Systems for One Way Beverage Containers: A Global Overview*, 2018, https://reloopplatform.eu/wp-content/uploads/2018/05/BOOK-Deposit-Global-27-APR2018.pdf

The deposit level has remained constant since the systems introduction, until September of this year when the deposit level was increased. The change was made due to deposit covered items becoming problematic in litter, and return rates for certain items deemed to be too low. The increase to deposit levels is ~17% for containers >500ml and 50% for containers <500ml.

Table 12: Deposit Levels in the Norwegian DRS

Rates from September 2018 (Between reseller and consumer)	Deposit (NOK)	Deposit (EUR)
Volume up to 50cl	2.00	0.21
Volume >50cl	3.00	0.31
Rates up to September 2018		
<50cl – Between manufacturer/importer and reseller	1.20	0.13
>50cl – Between manufacturer/importer and reseller	3.00	0.31
<50cl – Between reseller and consumer	1.00	0.10
>50cl– Between reseller and consumer	2.50	0.26

Chapter 7 – Packaging Waste[91]

Chapter 7 was also laid down pursuant to the Product Control Act of 1976, and later incorporated into the Pollution Control Act (1981) and the Waste Regulations (2004). It was further amended following the implementation of EU directives in 2005 and 2013.

Chapter 7 addresses packaging waste and the environmental issues related to it, aiming to increase reuse and material recovery and reduce environmental problems from packaging waste. It presents Norway's definition of packaging, of producer responsibility organisations and of treatment and recycling.

Responsibilities are set out for producers to work towards waste prevention, and allowance made for the Norwegian Environment Agency to issue further guidelines for waste prevention efforts in the future. Efforts made with respect to waste prevention are required to be reported by producers, either alone or as part of a producer organisation.

Producers who supply the market with more than 1,000 kg of packaging per year are required to finance collection, sorting, material recycling and other processing of used packaging and packaging waste through membership of a return company. The

[91] Forskrift om gjenvinning og behandling av avfall (avfallsforskriften) - Kapittel 7. *Emballasjeavfall - Lovdata*, accessed 15 November 2018, https://lovdata.no/dokument/SF/forskrift/2004-06-01-930/KAPITTEL_7#KAPITTEL_7

targets for recycling set out in the chapter are detailed in Table 13. This legislation was repealed in 2015, to allow for updates, and reapplied in 2017. For the majority of materials listed, these targets were in line with the PPWD Targets (prior to 2018 amends). For plastic packaging, Norway's recycling target is above that set by the PPWD – which sets a target of 22.5%. Norway also sets a specific target for expanded polystyrene.

Table 13: Recycling targets for packaging types

Packaging Type	Recycling Target
Plastic packaging	30.0%
Expanded polystyrene	50.0%
Paper packaging	60.0%
Cardboard	60.0%
Brown paper	65.0%
Metal packaging	60.0%
Glass packaging	60.0%
Wood packaging	15.0%

Updates to Chapter 7 on Packaging Waste (2017)

The 2017 updates to Norway's regulations on packaging waste looked to ensure that companies dealing with packaging waste were competing on equal conditions and that Norway achieves its binding targets for packaging waste under the EEA agreement.

The key changes made in the update were around the collection of packaging waste. Since the mid-1990s the business sector has been responsible for collection of packaging waste, which resulted in establishment of several Packaging Recovery Organisations (PROs) who have since been responsible for the collection and treatment of packaging waste. These PROs are bound by voluntary agreements and in recent years have come into competition with organisations not bounded by voluntary agreements which are cherry-picking the waste they choose to collect, collecting only the waste that is the most profitable. In response, and out of concern for the sound management of packaging waste, the Norwegian authorities have adopted regulations setting out statutory requirements for producer responsibility.

The new chapter of the Waste Regulations requires all PROs to be approved by the Norwegian Environment Agency. All companies that produce or import more than 1,000 kg of packaging or packaged products per year must belong to an approved PRO. Together with requirements relating to collection, treatment, and reporting, this will

ensure that competition between the PROs is fairer. For the present, the recycling targets set out in the current voluntary agreements on packaging and in the PPWD as currently in force have been retained. When new EU legislation on the circular economy is adopted, including new binding targets, these will be incorporated into Norwegian law as part of the EEA Agreement between Norway and the EU. The Waste Regulations will then have to be revised to take account of Norway's new obligations.

The new regulations also focus on waste prevention. Norway's authorities are planning to consult with the business sector on how to put waste prevention aims into practice, encouraging packaging optimisation.

Chapter 9 – Waste Disposal[92]

This chapter looks to ensure that landfill of waste is carried out properly so as to prevent or minimize adverse impacts on health or the environment. Under this chapter, a number of types of waste are banned from landfills. These are:

- biodegradable waste, with the exception of waste where the total organic carbon does not exceed 10%;
- road sweepings;
- polluted earth and polluted mud;
- liquid waste;
- explosive, corrosive, oxidising, highly flammable or flammable waste;
- medical and veterinary waste;
- tyres, with the exception of bicycle tyres; and
- industrial batteries and lead batteries.

The ban on landfill of biodegradable waste was introduced in 2009, and the approach was well enforced.

The chapter also states that the dilution or mixture of waste solely in order to meet the waste acceptance criteria is prohibited. Other requirements are stated in this chapter which aim to ensure the safety of landfill sites, but should not impact overall

[92] Forskrift om gjenvinning og behandling av avfall (avfallsforskriften) - Kapittel 9. *Deponering av avfall - Lovdata*, accessed 15 November 2018, https://lovdata.no/dokument/SF/forskrift/2004-06-01-930/KAPITTEL_9#KAPITTEL_9

waste treatment destinations. A requirement is also listed for landfill operators to report, at a minimum frequency of once per year, on the types and quantities of the deposited waste.

Furthermore, and looking to regulate the impacts that landfills have on their surrounding environments, the chapter contains provisions on how frequently landfill operators are required to monitor their landfill. Leachate composition and quantity is required to be monitored, as is the generation of landfill gas and impact on groundwater level and composition.

Chapter 10 – Incineration of Waste[93]

The purpose of this chapter is to ensure that incineration of waste takes place in a proper and controlled fashion to prevent and reduce damage to the environment and human health as far as possible. The chapter provides extensive definitions for types of waste, and types of incineration, and looks to regulate their processes accordingly.

A requirement in this chapter is that all incineration plants shall be designed, built and operated in such a way that all thermal energy is recovered as far as possible. Limit values are also set for the release of emissions of pollutants to air via flue gases. Emissions are required to be monitored to ensure reporting of any exceedances, and that they do not occur in the first place.

Chapter 11 – Hazardous Waste[94]

Provisions are provided around storage and handling of hazardous waste, with the aim to ensure that hazardous waste is dealt with in such a way that it does not create pollution or damage. The chapter requires permitting for entities handling hazardous waste, lays out the different categories for hazardous waste and details the requirements for their management.

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[93] Forskrift om gjenvinning og behandling av avfall (avfallsforskriften) - Kapittel 10. *Forbrenning av avfall - Lovdata*, accessed 15 November 2018, https://lovdata.no/dokument/SF/forskrift/2004-06-01-930/KAPITTEL_10#KAPITTEL_10

[94] Forskrift om gjenvinning og behandling av avfall (avfallsforskriften) - Kapittel 11. *Farlig avfall - Lovdata*, accessed 15 November 2018, https://lovdata.no/dokument/SF/forskrift/2004-06-01-930/KAPITTEL_12#KAPITTEL_12

Chapter 15 – Determination of Waste Collection Charges for Household Waste Management[95]

This chapter was added in 2014, taking effect from 2015. This allows municipalities to charge households for waste management via a waste fee. The waste fee is determined so that it corresponds to the total costs incurred by the municipalities from treatment of household waste (the fees are a cost recovery mechanism). Full cost coverage must be ensured, but the municipality shall not profit from such waste management. Only costs and income from household waste management shall be included in the calculation of the waste fee. Within this, the municipality is allowed to differentiate waste tariffs, where this contributes to waste reduction and increased recycling.[96]

The municipality must cover all costs using the fee, but may not profit from charging the fee. The following sources of revenue should be considered in calculating the fee charged:

- sales of district heating;
- electricity and biogas sales;
- sale of recyclable raw material (plastic, metal, etc);
- revenues as a result of trading in financial instruments related to the above;
- sale of compost and digestate; and
- sale of assets such as land, buildings, or machinery.

The following costs are expected to be covered:

- costs associated with the collection, transporting, receiving, storing, processing and control of household waste;
- labour costs incl. social costs to employees that treat household waste;
- operating costs related to plants which treat household waste;

[95] Forskrift om gjenvinning og behandling av avfall (avfallsforskriften) - Kapittel 15. *Fastsettelse av avfallsgebyr for håndtering av husholdningsavfall - Lovdata*, accessed 15 November 2018, https://lovdata.no/dokument/SF/forskrift/2004-06-01-930/KAPITTEL_17#KAPITTEL_17

[96] Miljodirektoratet (2014) *Calculation of Municipal Waste Fee - Elaboration of Waste Regulations*, Chapter 15, 2014.

- costs of management, operation and maintenance that relate to the management of household waste;
- costs associated with the purchase of assets such as buildings, land 7, machines, which are necessary to treat;
- household waste; and
- costs associated with contaminated soil and after operation of disused landfill caused by treatment of household waste.

Waste Prevention Programme (2013)[97]

The objective of Norway's Waste Prevention Programme is to achieve relative decoupling of economic growth from waste generation. However, within the waste prevention programme, the measures or means to break the link between economic growth and the environmental impacts associated with the generation of waste are not mentioned. The plan covers the construction and infrastructure sector, retail, transport and households as well as public services and hospitality and catering. Besides decoupling of waste from economic growth, specific quantitative targets are lacking from Norway's waste prevention programme.

Measures do exist on qualitative prevention. A website has been developed to provide users with information about green products, and on avoidance of products with hazardous substances. This is supported by the use of ecolabels, including the Nordic ecolabel "the Swan" and the EU ecolabel to ensure that products have a reduced impact on the environment when they become waste.

As part of the programme, the Norwegian Environment Agency and Statistics Norway developed food waste indicators and indicators for other waste streams. A revised version of the programme was due to be elaborated in 2017.[98]

Norway Waste Strategy (2013)

Norway's Strategy reviews the achievement of objectives in waste management and lays out the challenges and priority measures for the future. These look at waste prevention, recycling and hazardous waste. Quantitative targets are set in this strategy and it meets the EU requirement for a national waste plan.

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[97] European Environment Agency (2016) Overview of National Waste Prevention Programmes in Europe: Norway.
[98] European Environment Agency, *Waste Prevention Programme: Norway Fact Sheet* October 2016. European Environment Agency (2016) Overview of National Waste Prevention Programmes in Europe: Norway.

The quantitative targets set are:

- Increases in waste generation shall be significantly lower than economic growth;
- A recovery target (recycling and energy recovery) of 75% is set for 2010 with aim for that to increase in future up to 80%;
- Hazardous waste should be handled properly either recovered or undergo adequate treatment; and
- The generation of hazardous waste should be reduced by 2020 compared with 2005 levels.

In addition to these quantitative targets there is a recognition for the need to invest in research and development of environmental technologies which can contribute to improving Norway's waste and recycling performance. Alongside this, the strategy aims to prioritise the best use of resources and prevent hazardous substances being incorporated into new products or entering the environment. It also aims to improve the recovery of electrical and electronic waste including collection of small electronics and ionising smoke alarms.

Furthermore, the waste strategy planned to improve communication between government authorities, municipalities and the industry. A contact forum was planned for waste to allow the industry and authorities to discuss challenges in the sector.

Finally the strategy mentions establishment of producer responsibility schemes for recreational craft, fishing gear, and equipment from the aquaculture industry.

3.7.4 Challenges

Norway faces challenges in that a greater focus will need to be placed on separate door to door collection from households to achieve higher recycling rates going forwards.

Norway's recycling rate has stagnated in recent years and even decreased slightly between 2016 and 2017. Separate door to door collections are in place at present for food waste, which is collected in 70% of municipalities. Door to door collections are also the most common collection method for both plastic and paper packaging – collected in 87% and 98% of municipalities respectively.

However, door to door collection is less common for metal and glass and moving away from reliance on bring-banks for these recyclables I likely to be important.

Regional differences in recycling rate are also notable in Norway and the presence or absence of food waste collections is thought to be important in determining this. In addition to this, as recycling collections are a municipal responsibility in Norway there is room for greater consistency in approach to collections which can improve consumer understanding and send a clearer message about desired recycling behaviour, as well as ensuring that all municipalities offer a service that is likely to drive high recycling performance.

Whilst Norway is a world leader in the development and application of recycling and sorting technologies, Norway's collection systems should not become over reliant on sorting recyclables from mixed waste or co-mingled streams. The concern here is that the quality of certain streams such as paper and cardboard is considerably higher when separated at source than when extracted from more mixed streams. Additionally, material losses from sorting technologies are greater than those from separate collection and this becomes a particular issue when recycling targets rise. As such, whilst sorting technologies will likely form a valuable part of Norway's approach to meeting the increasing recycling targets, they should be used in conjunction with approaches which prioritise separate collection and high capture rates of high quality of recycling. However, the role of mixed waste sorting prior to incineration to capture recyclable fractions remaining in residual waste will continue to be an important "backstop".

In addition, The National Waste Plan identifies a need for a greater focus on waste prevention especially for food waste, construction and industrial waste, electrical products and textiles. In the future, cost-effective solutions need to be developed and the recovery of textiles must be properly initiated – not least to meet the targets of the new EU Directives. As regards the collection of waste, the recycling rate needs to increase for discarded small electronics, for example mobile phones.

Increased collections of hazardous waste, and treatment of hazardous waste collected has contributed to reducing the environmental impact of Norway's waste.[99] In addition, ensuring that new products placed on the market contain less hazardous substances will be important. In order to achieve this, product standards or design requirements could be developed, however this is a task which would benefit from

[99] *Statsistisk sentralbyra - Statistics Norway: Farlig avfall*, accessed 4 January 2019, https://www.ssb.no/natur-og-miljo/statistikker/spesavf/aar/2018-12-11

international collaboration and cooperation. There is also a need for research in the waste sector, with key areas of focus including hazardous substances and nanoparticles.

However, in some respects, meeting the increased recycling targets presents an opportunity for Norway. Access to sector-leading technology, a political appetite for sustainability and interest from the public all contribute to potential success in meeting the future targets. Norway has also been leading the way globally in respect of plastic pollution, this is recognised, and should be continued in future.

3.8 Sweden

Sweden is part of the Scandinavian Peninsula. It has a population of 10.2 million, and a low population density given its extensive (173,860 sq mile) area. The majority of the population lives in the southern half of the country. Sweden is an EU Member State, having joined in 1995.

3.8.1 Current and Historic trends

The current definition of municipal waste in Sweden is that it is equivalent to household waste. Household waste refers, according to the Swedish Environmental Code, to waste from households and comparable waste from other activities. Waste comparable with household waste which resembles waste arising when using land or housing for residential purposes. There are no previous definitions of municipal waste that have been used in Sweden.

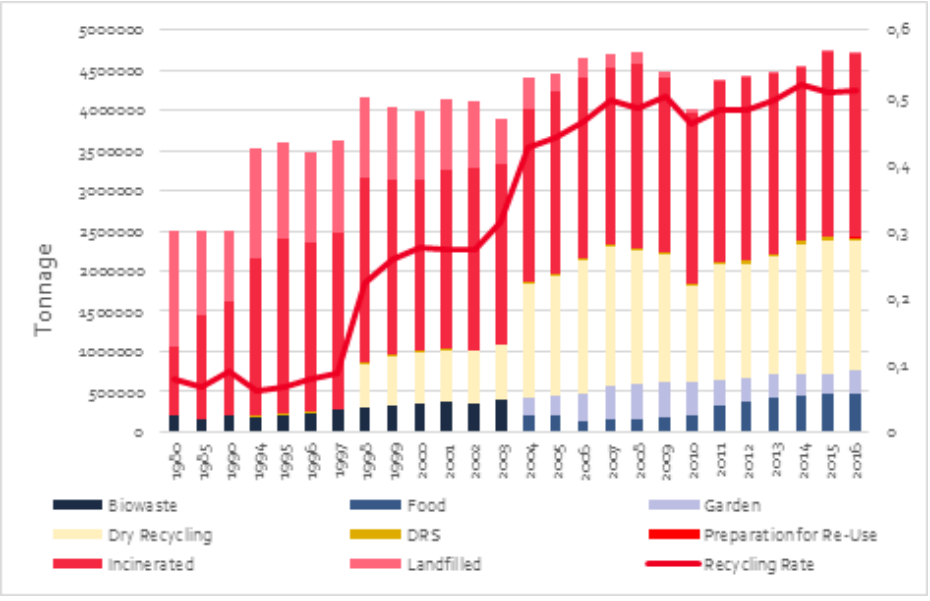
Recycling is counted as the amount of waste collected for recycling. Sweden reported a 48.9% recycling rate for municipal waste in 2016, and has reported a recycling rate in the high 40s since 2006. However, the reported recycling rate has stagnated since 2008, hovering between 45–50% since then. This could be attributed to the fact that policies have not changed much during the period, although there has been discussion around producer responsibility and how to change this.

In the period since 2008, there has also been little political change. Swedish politics is now entering a period of change and hence there may be forthcoming adjustments to waste policies. It is also worth recognising that Sweden's reported recycling rate for some materials may be considerably higher than that which is actually recycled. Recent figures suggest that for plastics, the percentage recycled from that collected could be

as low as 20–25% with the remaining quantity incinerated in waste to energy facilities.[100,101] This issue also affects Iceland who export their plastic waste to Sweden.

Currently, 100% of Sweden's population is covered by municipal waste collections.

Figure 28: Household Waste Arisings in Sweden by Treatment Route and Recycling Rate



Note: Excludes years where data was not available.

Figure 28 shows household waste arisings in Sweden by treatment route, demonstrating the tonnage treated under each method and the resulting recycling rate. Landfill has decreased since 2001 since the introduction of the landfill of waste regulations. Food waste collection and recycling has increased due to more municipalities collecting it as a separate waste fraction. In tandem with this, biogas production in Sweden has also increased. Dry recycling collections have also increased in Sweden over the time period shown, with both the number of households covered

[100] ABC News (2018) *How would burning rubbish like Sweden work in Australia?* http://www.abc.net.au/news/2018-08-14/how-would-burning-rubbish-like-sweden-work-in-australia/10115694 Date accessed: 21/08/18

[101] Zero Waste Europe (2017) *Sweden's Recycling (D)Evolution* https://zerowasteeurope.eu/2017/06/swedens-recycling-devolution/ Date accessed: 21/08/2018

increasing alongside the range of recyclables collected. Since 2004, biowaste has been reported as its separate constituent fractions; food waste and garden waste. The total amount of waste and the recycling rate have increased the most recent years shown.

3.8.2 Approach to Waste Collections

Sweden has separate collection schemes for all packaging waste types (paper, metal, plastic and glass). Producers are responsible for collection of packaging waste and newspapers and pamphlets. This collection system is a nationwide network of recycling stations.

Every municipality must offer a collection system for all household wastes which are not covered in the producer responsibility according to 15 kap 20§ in the Swedish environmental code. Hence, the municipality chooses the solution for collection. It means that the collection systems varies between municipalities.

For the waste fractions covered under producer responsibility the bring system is the most common system. The nationwide bring system is provided by the producers through the organisation FTI. There is a change in pattern, with more and more municipalities offering collection of producer responsibility fractions closer to the households. Currently approximately 35% of the Swedish households access collection of producer responsibility fractions closer to the households. However, the collection systems that the municipalities or property owners offer to the households varies.

The most common systems for detached houses are:

- two separate bins (one for residual waste and one for food waste) + bring system – 49%;
- one bin (residual waste and food waste are not separated) + bring system – 25%;
- multi compartment bins (mostly four compartment bins) – 15%;
- optical sorting system (mostly two different plastic bags, one for residual waste and one for food waste, but some municipalities have several different bags for residual waste, food waste and recyclable waste [e.g. paper packaging, plastic packaging]) – 10%.

In 2015, 40% of apartment blocks and 10% of detached houses in the countryside were served by a kerbside collection. Many municipalities provide a collection for plastic that is not packaging, described as municipal plastic waste, of which over 11,000 tonnes was collected for recycling in 2016.[102] Almost all 290 municipalities have recycling centres, which accept bulky and hazardous waste. Of these around 25 were partnered with aid organisations in 2016 to provide reuse centres for clothes, furniture and reusable household items. In addition, around half of recycling centres have simpler means for accepting materials for reuse.[103]

Avfall Sverige, the Swedish Waste Management and Recycling Association, and the electrical producer's companies El-Kretsen and Recipo collaborate on a return system for WEEE from households. The municipalities collect the WEEE, and the producers are responsible for treatment, remunerating the municipalities for their role. Collection of these items is via municipal recycling centres, of which there are 583 in Sweden. The majority of Swedish municipalities also collect WEEE through kerbside collections.

In 2016, 73% of Swedish municipalities (212 of 290) collected source-segregated food waste from households. By 2017, this had increased to 223 of Sweden's 290 municipalities.[104] Sweden has a target for 2018 of 50% of food waste from households, institutional kitchens, shops, and restaurants to be sorted and processed biologically so that nutrients are utilised.

Separate collection systems exist for hazardous waste and bulky waste from households.

3.8.3 Financing of Waste Collection

The cost of waste collection in Sweden is recouped through a waste collection charge set by the municipality. The average annual waste collection charge for a Swedish household in a single-family house in 2017 was SEK 2,094 or EUR ~200. Households in apartments pay less than this – around SEK 1,329 or EUR 130. Municipalities introducing the voluntary collection of food waste may use the charge as an incentive and some

[102] Avfall Sverige (2017) *Swedish Waste Management 2017*, 2017, https://www.avfallsverige.se/fileadmin/user_upload/Publikationer/Avfallshantering_2017_eng_low.pdf
[103] Avfall Sverige (2017) *Swedish Waste Management 2017*, 2017, https://www.avfallsverige.se/fileadmin/user_upload/Publikationer/Avfallshantering_2017_eng_low.pdf
[104] Avfall Sverige (2018) *Swedish Waste Management 2018*, 2018.

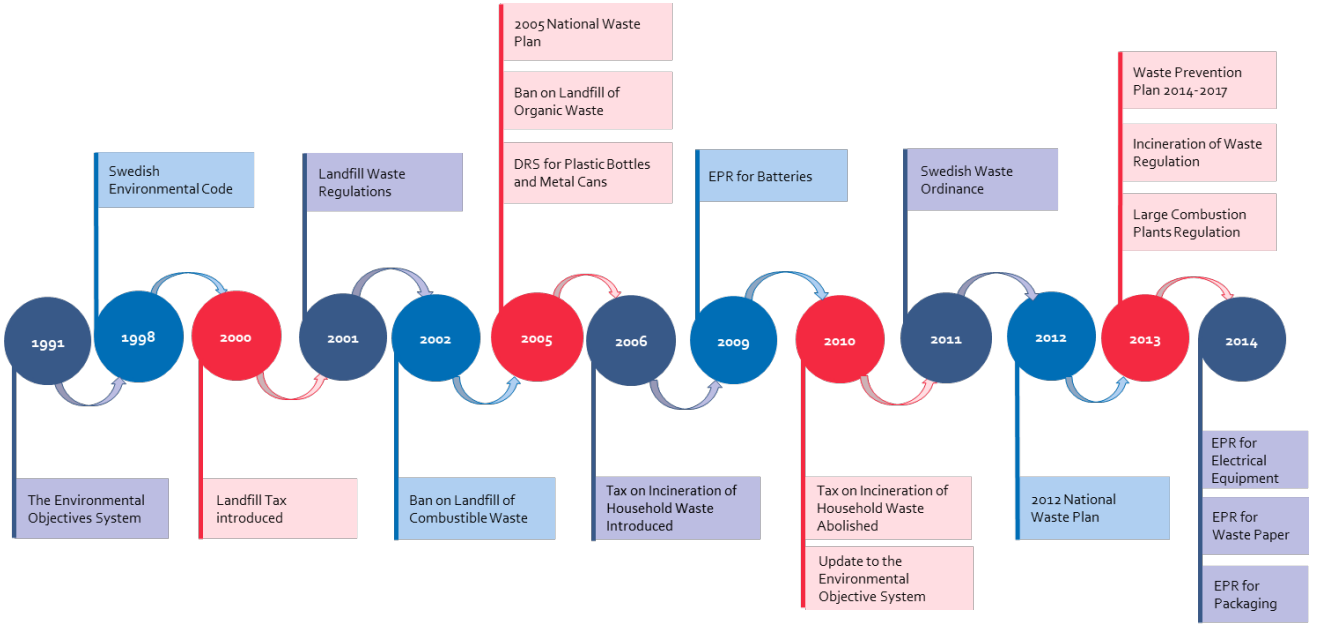
reduce the charge to households who separate their food waste. PAYT systems are uncommon in Sweden. However, they are used in 30 of Sweden's 290 municipalities or around 10% of municipalities. Typical charges are between 0.90–3.90 SEK/kg or 0.087–0.38 EUR/kg for residual waste and between no charge and SEK 3 or 0.29 EUR/kg for food waste. These are combined with the fixed basic charge.[105]

[105] Avfall Sverige (2017) *Swedish Waste Management 2017*, 2017, https://www.avfallsverige.se/fileadmin/user_upload/Publikationer/Avfallshantering_2017_eng_low.pdf

3.8.4 Policies

Figure 29 shows the development of Swedish waste policy.

Figure 29: Waste policy timeline for Sweden



The Environmental Objectives System (1991)

The 1991 Environmental Objectives System set goals for environmental policy as a whole in Sweden for the first time. The aims were to protect human health, preserve biodiversity, and reduce the exploitation of natural resources so that they can provide for the long term and protect natural and cultural landscapes.

The overall goal of Sweden's environment policy, as described by the Swedish Parliament is:

> "to hand over to the next generation a society in which the major environmental problems in Sweden have been solved, without increasing environmental and health problems outside Sweden's borders" – the "generational goal".

Sixteen environmental quality objectives were adopted in 1999 which describe what the policy aims to achieve. Environmental quality objective number 15 "A good built environment" contains provisions relating to household waste.

In 2010, a new target structure, organisation and assessment basis were introduced for the environmental quality objectives.

The Swedish Environmental Code, Chapter 15 – Waste and Producer Responsibility (initially introduced in 1998)

The Environmental Code lays out the fundamental environmental rules which make a framework for more detailed provisions. The environmental code was the result of a major consolidation, and reform, of the environmental legal framework in Sweden, and replaced fifteen previous environmental acts, aiming to reduce the quantity of legislation whilst simplifying and clarifying it.

The Code states that waste should be recycled, reused or recovered insofar as possible and disposal should be carried out without damaging the environment. The ultimate objective is to maintain closed material cycles.

The Code has changed over time. Changes were made so that the provisions of the waste hierarchy of the EU WFD were fully integrated into the Environmental Code.

The waste hierarchy is largely introduced in Chapter 15 of the Environmental Code. In order to adapt the chapter to the hierarchy, both systematically and terminologically, the chapter has been repealed and replaced with a new one. These amendments entered into force on August 2, 2016. The waste hierarchy's prioritization scheme can be deviated from if it gives a better result for human health and the environment as a

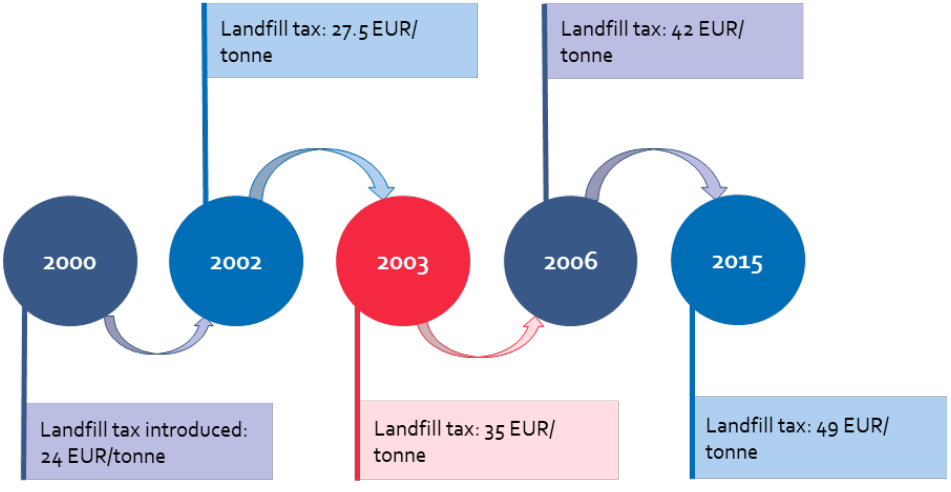
whole or if the treatment method to be used according to the hierarchy has unreasonable consequences.

Provisions on producer responsibility are also introduced under the rules in Chapter 15 of the environmental code (Sections 6–7a). Legislated producer responsibility exists in Sweden for ten product types: packaging, paper, plastic bottles and metal cans, cars, tyres, electrical and electronic products, batteries, filament bulbs, pharmaceuticals and radioactive products. This producer responsibility requires, inter alia, collecting and treating products that have become waste, and financing the costs of this.

Landfill Tax (2000)

The tax on waste deposited in landfills was introduced in 2000 as a means of reducing the quantity of waste sent for disposal at landfills. In 2000, the tax on waste sent to landfill was 250 SEK/tonne, approximately 24 EUR/tonne. Since its introduction the landfill tax rate has been increased in intervals – rising to SEK 288 or ~27.5 EUR/tonne in 2002, SEK 370 or ~35.2 EUR/tonne in 2003, SEK 435 or ~41.4 EUR/tonne in 2006 and since 2015 has stood at SEK 500 or ~49 EUR/tonne. This development in landfill tax rate over time is shown in Figure 30.

Figure 30: Timeline of Swedish Landfill Tax



Landfill of Waste (2001)

The landfill of waste regulations aimed to prevent and reduce the negative effects of landfill of waste to human health and the environment. The regulation prohibited the following waste types from deposit at landfill:

- liquid waste;
- waste which is explosive, corrosive, oxidising, flammable or highly flammable;
- medical waste and other clinical waste from medical or veterinary activities;
- waste consisting of chemical substances from research and development or teaching which are not identified or whose effects on health or the environment are unknown;
- whole used tyres that are not bicycle tyres;
- flammable waste;
- combustible waste (inclusion from 2002); and
- organic waste (Inclusion from 2005).

In 2008, the landfill of waste regulations were updated due to implementation of the EU battery directive. In accordance with this, batteries not treated under certain provisions of the waste ordinance must not be landfilled or incinerated, and as such, batteries were added as a waste type which may not be landfilled.

Under the Waste Ordinance, batteries are prohibited from being incinerated as well as landfilled without fulfilling pre-treatment conditions as follows:

- liquids and acids have been removed from the batteries to be handled separately from the batteries waste; and
- the actions to reach the goals for special disposal and recycling that are specified in 8 § directive (2008:835) about producer responsibility for batteries are met.

Return Systems for Plastic Bottles and Metal Cans (2005)

The 2005 regulation on return systems for plastic bottles and metal cans looked to increase the quantity of packaging waste that is recycled and to fulfil recycling targets through producer responsibility. The legislation applied to the placing of a beverage contained in plastic bottles or metal cans on the Swedish market and requires importers

or producers to ensure that the beverage container is part of an approved DRS. Some beverage types are exempt from the requirement, such as: dairy products, and fruit and vegetable juices.

The deposit level is currently set at SEK 1 (EUR 0.10) for plastic bottles, SEK 2 (EUR 0.20) for large plastic bottles and SEK 1 (EUR 0.10) for metal cans. These deposit levels have been in place since 2010, prior to which metal cans were charged at SEK 0.5 (EUR 0.05). However, with the disappearance of the half a Swedish crown coin, the deposit level was changed. The return rates achieved in 2016, were 84.9% for plastic bottles and 84.9% for aluminium cans.[106]

Sweden's National Waste Plan (2005)

The priorities identified in the 2005 Swedish National Waste Plan involved shifting the focus of the plan to reducing the hazardousness of waste, and reducing the quantity of hazardous waste. It also looked to develop Sweden's knowledge of environmental hazards. Additional aims were to facilitate ease of recycling for Swedish households and to develop Swedish participation in the EU's waste work.

While the document covered achievements up to its release, it recognised the scope of unrealised potential for further efficiency savings in Sweden's waste management. A number of areas for action were identified in order to achieve waste management goals:

- Implement the regulations and use the instruments decided while monitoring progress to ensure they achieve the desired effect;
- Place greater emphasis on reducing the quantity of waste and the hazard it poses;
- Improve knowledge about pollutants;
- Make it easy for households to sort their waste;
- Develop Swedish participation in EU work in the waste management field.

[106] Reloop, and CM Consulting (2018) *Deposit Systems for One Way Beverage Containers: A Global Overview*, 2018, https://reloopplatform.eu/wp-content/uploads/2018/05/BOOK-Deposit-Global-27-APR2018.pdf

These areas of focus were developed after a period of considerable change in Sweden's waste management approach. They reflect the country's sustainable development goal, through which all political decisions are evaluated on their long-term economic, social and environmental implications.

Tax on Incineration of Household Waste (2006)

A tax on incineration of household waste was introduced in 2006. The tax level was calculated on the basis of the fossil carbon content of the waste. The tax was later abolished in 2010. Having been introduced under a "green" government in Sweden, the tax responded to criticism on increasing incineration capacity, but was abolished under a conservative government in 2010 who removed it because they felt it ineffective in increasing recycling rates and stimulating recycling. The tax applied only to municipal waste, not to commercial and industrial waste.

The waste incineration tax, when active, was based on the fossil carbon content of household waste. However, it was recognised that the composition of household waste is heterogeneous and measuring carbon content regularly was unfeasible. As such, the figure used to calculate carbon content was set at 12.6% of weight. The CO_2 tax in 2008 was set to SEK 3,709 or ~350 EUR/tonne of fossil carbon. This equated to around EUR 45 per tonne of waste. In addition to the CO_2 tax, an energy tax was charged which equated to around EUR 2 per tonne of waste. These are the taxes which would apply to a Swedish incineration plant with no energy recovery. Reductions in CO_2 tax of up to 79% and exemption from energy tax could be achieved for plants efficiently generating electricity from waste incineration, with the greatest reduction in tax available for the most efficient plants – this applied to both electricity only and combined heat and power (CHP) plants. No tax reduction was granted for heat only incineration plants. However, when industrial companies purchase heat from an incineration plant, the plant pays the lower industrial tax rate for the heat.[107]

In practice, 95% of incinerated household waste was subject to the tax reductions and exemptions, with the net average tax working out at ~90 SEK/tonne or approximately 9 EUR/tonne.

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[107] *Skatt i retur - Betänkande av ASKA-utredningen* (2009) https://www.regeringen.se/49bb37/contentassets/90e90f1fc83f4a3da320b1b25b61f819/skatt-i-retur-sou-200912 Date accessed: 21 August 2018.

Producer Responsibility for Batteries (2009)

This legislation intended to create a system where batteries were designed and manufactured in such a way as to prevent the occurrence of waste. For the waste that occurs, producers should provide a system for collection of waste and recycling to fulfil collection requirements in the regulation. The following targets were also set in the legislation:

- 95% of lead-containing car batteries, and industrial batteries, are collected;
- 95% of the total sales of non-lead car, and industrial, batteries are collected; and
- 75% of the total number of batteries sold, other than those referred to in the first two targets, are collected.

There is additional regulation relating to special disposal and recycling of batteries containing other hazardous substances, such as mercury and cadmium.

Swedish Waste Ordinance (2011)

The Swedish waste ordinance contains provisions on waste and waste management as well as some key definitions for Swedish waste policy. It regulates handling of combustible waste, hazardous waste and organic waste. It also contains requirements for handling of packaging waste and waste paper.

A requirement is included for the separate collection of packaging waste from both commercial and household entities. Similar obligations are included for the separation and separate collection of waste paper.

Sweden's National Waste Plan (2012)

Sweden's national waste plan describes the management of waste in Sweden and what is needed to reach a more resource-efficient society based on environmental objectives and the EU waste hierarchy. The plan contains goals and actions for priority areas. There is a focus on reuse and recycling with an aim for reuse of household waste to increase, partly through making it easier for households to deliver products for reuse and to be prepared for reuse. It also aims to increase the reuse of textiles and the recycling of textile waste.

The priority areas are:

1. Handling of waste within construction sector;
2. Waste from households;
3. Resource management within food sector;
4. Treatment of waste;
5. Illegal export of waste.

The goals under each of these are as follows:

- Handling of waste within construction sector:
  - By 2020, preparation for reuse, recycling of materials and other materials. Utilization of non-hazardous construction and demolition waste be at least 70% by weight;
  - The safe, and environmentally considered, use of waste and materials in construction work should increase.
- Waste from households:
  - Reuse of household waste shall increase;
  - Reuse and material recycling of textile waste shall increase;
  - Material recycling of household waste shall increase and at least 90% of the households shall be satisfied with the collection;
  - Collection of E-waste to material recycling shall increase;
  - Littering shall decrease.
- Resource management within food sector:
  - Food waste shall decrease;
  - By 2018 at least 50% of food waste from households, kitchens, shops and restaurants are sorted out and treated biologically so that nutrition is taken care of, where at least 40% are treated, so that energy is also taken advantage of.

- Treatment of waste:
  - All end of life vehicles shall be delivered to authorized car scraper and remediation and dismantling of end-of-life vehicles should be improved;
  - The risk for negative environmental impact from deposited landfills shall decrease;
  - Waste incineration plant shall have continuous sampling of emissions of dioxins and furans;
  - All waste shall be stored or controlled so that fires do not occur.
- Illegal export of waste:
  - Illegal transports of waste from Sweden shall not occur.

There is a new national plan for 2018–2023.

Incineration of Waste (2013)

The 2013 regulation on the incineration of waste aimed to minimise the environmental impact from incinerators. It required operators to monitor the quantities of waste types received at the facility, and follow emissions requirements. It succeeded the 2002 regulation on waste incineration and looked to tighten emissions requirements, putting in place stricter requirements on NO_x and SO_x emissions. Some of the provisions of the directive are implemented by supplementing or revising other Swedish rules that have previously applied. This applies, for example, to licensing, requirements for what a judgment should contain, requirements for the operator's own control and requirements for annual environmental reports.

Large Combustion Plants (2013)

The 2013 regulation on large combustion plants aimed to minimise the environmental impact from such plants. It looked to do this by placing regulation on such plants implying that emissions requirements are tightened for power plants, CHP plants and district heating plants. The addition to cover district heating plants was made in 2016.

Classification of plants meant that this regulation did not affect the majority of Swedish plants, with 150 facilities classified as large (50MW+), and a further 1,800 plants classified as medium-large (1–50 MW). Thus the total number of plants captured by the legislation was 1,950.

Swedish Waste Prevention Programme for 2014–2017 (2013)

The Swedish waste prevention programme for 2014–2017 was designed to guide and encourage stakeholders towards reaching the Swedish national environmental objectives. It aims to ensure that less waste is generated, products are promoted that are designed without hazardous substances, and that this is done regardless of impact on economic growth.

The programme contains eight long term objectives and 167 measures. Progress towards the objectives is monitored by the Swedish EPA, and a new waste prevention programme is due in 2018. The four priority areas of the programme are food, textiles, electronics and construction and demolition. These waste types were chosen as priorities due to their significant contributions to both waste and carbon emissions. The eight goals of the programme are as follows, listed underneath the priority area that they address:

- Overall Targets:
  - The amount of waste should decrease continuously compared to 2010;
  - The content of hazardous substances in materials and products should decrease.
- Food waste:
  - Food waste throughout the food chain will decrease compared to 2010.
- Textile Waste:
  - Textile waste from households will decrease compared with 2010;
  - The proportion of second-hand goods of total textile sales will increase compared to 2014;
  - The textile industry's knowledge of the use of content of hazardous substances in textile has increased compared to 2014.
- Construction and demolition waste:
  - By 2020, less waste per built square meter will occur compared to 2014.
- Electronic waste:
  - By 2020, waste recyclers and recyclers have access to appropriate information on the composition of the products and the content of hazardous substances compared to 2014.

Producer Responsibility for Electrical Equipment (2014)

This policy aimed to increase the quantity of electrical waste which is recycled and handled properly. This was achieved through assigning producer responsibility to those introducing electrical equipment onto the Swedish market. This mean that producers had responsibility for the equipment when it becomes waste.

A producer should also belong to an approved collection system, provide information about what the product contains, label their product, design the product to promote recycling and reuse and, on request, report to the Swedish Environmental Protection Agency on how they fulfill the requirements mentioned.

The obligation to sort out electrical waste from other waste can be found in the Waste Ordinance. The waste ordinance states that:

> "Those who hold waste containing or consisting of electrical or electronic products should sort it out and handle it separately from other waste."

This applies to both municipalities collecting electronic waste and return via stores.

In 2014, the policy was updated to include the new definitions from the WEEE directive, and in 2015 requirements were added for the design of equipment containing batteries.

Producer Responsibility for Waste Paper (2014)

Similarly to the producer responsibility policy for electrical equipment, Sweden has in place a producer responsibility policy for waste paper which aims to increase the recycling of waste paper. Producers are responsible for paper when it becomes waste and should belong to an approved collection system and report the results of the collection, reuse, recycling and material utilisation to the Swedish Environment Agency. Sweden has set a goal of a 75% recovery rate for waste paper before January 2020, and 90% thereafter. The target is measured based on how much material is collected versus what has been put on the Swedish market.

Producer Responsibility for Packaging (2014)

Through producer responsibility, this policy aimed to increase the amount of packaging waste recycled and handled properly to fulfil recycling targets in the regulation. Goals are set for what is referred to in the policy as the "material utilisation rate" and equates to the recycling rate of the material in the year, generated through comparison of the quantity put on the market with that recycled. These goals are shown in Table 14, to

calculate if targets are reached the amount of waste recycled in a calendar year is divided by the production volume (manufactured or imported). Waste transported to a non-EU country may only be deemed as recycled under these requirements if it can be shown that it has been recycled in accordance with requirements in the regulation.

Table 14: Packaging recycling targets in Sweden

Packaging Type	Recycling Rate Target
All packaging waste	55% before January 2020, 65% thereafter
Paper and cardboard	65% before January 2020, 85% thereafter
Plastic (not including beverage packaging)	30% before January 2020, 50% thereafter
Polymeric materials (beverage packaging)	90%
Glass	70% before January 2020, 90% thereafter
Metal beverage packaging	90%
Metal packaging (not including beverage)	70% before January 2020, 85% thereafter
Wood	15%
Other	15%

Future Swedish Waste Policy

Sweden announced in 2018 that it would be introducing new regulations on producer responsibility for packaging and recycled paper and amending waste policy. The changes implemented aim to make waste collection more readily accessible with municipalities providing systems for collecting sorted food waste from households. Organisation of the collection system is delegated to the municipalities. However, the requirement will be introduced alongside new provisions on producer responsibility for packaging and recycled paper to create an incentive for municipalities to plan and build a coherent collections system together with producers.[108]

3.8.5 Challenges

Sweden has a highly developed waste management system and industry. This provides a good platform for responding to the challenges of increasing resource efficiency and meeting the future requirements of EU legislation. However, it also poses a challenge,

[108] Regeringen: *Rule changes decided on 28 June 2018* https://www.regeringen.se/artiklar/2018/07/regelandringar-beslutade-den-28-juni-2018/ Date accessed: 13 August 2018.

in that significant change is required and existing approaches and infrastructure have the potential to inhibit change.

It seems clear that the on-going trend for increased separate door-to-door collection from households will have to continue if higher recycling rates are to be achieved. One challenge to this may be the separation of responsibilities between municipalities (responsible for collecting mixed residual waste and separate biowaste) and producer responsibility organisations (PROs, responsible for collecting packaging and paper). The split of responsibilities can lead to a lack of integration of collection systems, as the overall economics of a recycling-led system (collection cost, sorting cost, income from sale of secondary materials, contributions from producers, avoided costs of disposal) are split between the two separate systems. PROs have an understandable tendency to focus resources on lower cost collection methods such as bring systems in order to keep costs of compliance for their members low. In addition, the low cost of disposal of mixed residual waste in Sweden does not provide the same economic incentive to separate and recycle materials as is seen in many other EU Member States.

The roll-out of door-to-door separate collection for a wide range of recyclables is likely to require greater integration of the efforts of municipalities and producers. There are many examples of high performing door-to-door collections in Sweden, particularly in the South of the country, but there are also many examples of low performing systems, with municipalities relying heavily on producer-funded networks of bring banks for separate collection of many dry fractions. There is considerable diversity of collection systems across the country and adequate incentives do not currently exist to drive municipalities to adopt comprehensive door-to-door collection or for producers to collaborate in funding and managing these enhanced services. Reform of the producer responsibility system for packaging is likely to be required in the near future in any event in order to comply with changes in requirements at EU level and this may present an opportunity to align the economic interests of municipalities and producers with a view to a more integrated system. What does seem clear is that future targets will not be able to be met without a significant expansion of door-to-door collection schemes.

Regarding incineration, Sweden's capacity was 591 kg per person (6.6 M tonnes overall) in 2017, which is very high by EU standards. This level of incineration capacity is inconsistent with the achievement of the recycling targets outlined in the WFD, without the reliance on imported waste to maintain use of incinerator capacity as more Swedish waste is diverted for material recycling. However, Swedish incineration plants

are amongst the most efficient in the world, primarily due to their integration with well-established district heating networks. The import of refuse derived fuel from other European countries can help to avoid over-capacity developing in those countries and can help to support the industry in Sweden as the country switches to a more recycling-led approach. Different approaches could be taken to driving this shift, including taxes, bans and collection and sorting requirements to name but a few.

The long-term goal is a circular economy in which waste will not, in principle, arise and resources will be retained in society's circulation, or returned to nature's own cycle in a sustainable way. Products should be designed to be durable, repairable and it should be possible to reuse and eventually recycle materials. In particular, hazardous substances should be phased out of the circuit. An important starting point for Swedish work would be to consider design requirements which look to avoid the inclusion of hazardous substances in new products.

To succeed in transitioning to a circular economy requires new technology, new innovative products and services, sustainable and resource-efficient business models, as well as changes to consumer behaviour. A combination of different types of instruments and actions and cooperation between different actors and sectors is needed to achieve this. The Swedish Government has presented a number of strategies for Sweden and has also implemented or carried out a number of investigations that are important for the conversion to a circular economy to date.

3.9 Summary

A summary of the key policies of interest is shown in Table 15.

Table 15: Key policies by country

Nordic Country	DRS (List items covered)	Landfill tax (and rate in latest year)	Incineration tax (and rate in latest year)	Landfill bans (list waste types)	Separate collection of biowaste	PAYT	Recycling collections	Residual waste collection	EPR
Åland	Glass bottles, aluminium cans and recycled plastic bottles	1996 introduced. ≈EUR 70/t in 2017.	None	Biodegradable waste has been banned from landfills (with the exception of dead wild animals, pets and animal by-products, according to Sector 5 Decree on Landfill, 2007:3)	Sector 7 and 8 in the Decree on Waste 2011:74, separate collection should be organized for paper, metal, glass and biological waste.	A waste charge is paid by households, which looks to cover costs of transport and disposal and is determined by waste stream, its quality and quantity and number of pickups.	Opt-in for household collection for all households on Fasta Åland, bring schemes in other municipalities covering paper, cardboard, tetrapaks, hard plastics, glass, metals and in some municipalities organic waste	Residual waste collected from households on Fasta Åland, and via bring sites elsewhere	WEEE 2007

Nordic Country	DRS (List items covered)	Landfill tax (and rate in latest year)	Incineration tax (and rate in latest year)	Landfill bans (list waste types)	Separate collection of biowaste	PAYT	Recycling collections	Residual waste collection	EPR
Denmark	Glass bottles, plastic bottles, metal cans	1987 introduced	Introduced 1987, change to calculation method in 2010 – 4.25 EUR/GJ of CO_2 in 2018, 23 EUR/tonne of fossil waste (plastics)	1997 – Landfill ban on combustible waste	37% households	Small proportion, covers 2–3% of households with weight based PAYT. Most municipalities have a volume based fee for residual waste where households can save money by opting to use a smaller container	Combination of door to door and bring bank covering paper, cardboard, glass, metals and plastic	Fortnightly	WEEE 2005, ELV 2007, batteries 2009
Faroe Islands	Beverage containers on certain drinks (beer, soft drinks and water <20 litres. Incl. Glass, metal and plastic bottles	None	None	None	No	Commercial waste is covered by PAYT	Household collection of paper, cardboard and hazardous waste. Local receiving stations for paper and carboard, metals, organic waste from sheep slaughter, garden waste, electronic waste and hazardous waste		2004 – ELV, tyres, WEEE, batteries, paper, packaging

Nordic Country	DRS (List items covered)	Landfill tax (and rate in latest year)	Incineration tax (and rate in latest year)	Landfill bans (list waste types)	Separate collection of biowaste	PAYT	Recycling collections	Residual waste collection	EPR
Finland	Metal cans, plastic bottles,glass bottles	1996 introduced. ≈EUR 70/t in 2017.	None	Ban on landfill of biodegradable waste – announced in 2013, implemented in 2016. Essentially bans the landfill of mixed waste	Coverage varies by household type – up to 87% coverage for apartments, 78% for row houses, and around 20% for detached houses	Waste charge is paid by households and is a combination of transport and treatment costs	Mix of door-to-door collections, bring sites and recycling stations, DRS and campaign collections for specific streams. Materials covered are: Biowaste, paper and cardboard, glass, metals, paper, and plastics		2005 – ELV, tyres, WEEE, batteries, paper, packaging
Greenland	(Introduced 2002) Plastic and glass bottles, West Greenland only and only for carbonated soft drinks and beer	None	None	None	None	None	Bring collections for large WEEE	Weekly	

Nordic Country	DRS (List items covered)	Landfill tax (and rate in latest year)	Incineration tax (and rate in latest year)	Landfill bans (list waste types)	Separate collection of biowaste	PAYT	Recycling collections	Residual waste collection	EPR
Norway	(Introduced 1976) Metal cans, and plastic bottles	None	None	Ban on landfill of biodegradable waste	70% of population have access to separate food waste collection	Limited use of PAYT in two municipalities	Vary by municipality: 70% offer separate collection of biowaste, 87% separate collection of plastic packaging, and 98% separate collection of paper packaging.		WEEE, batteries, packaging
Sweden	(Introduced 2005) Plastic bottles and metal cans	2000 introduced, 49 EUR/tonne in 2015	None at present, incineration tax for household waste active 2006–2010	Ban on landfill of organic waste (2001)	77% of municipalities provide food waste collections to some extent. All municipalities are to provide a collection by January 2021	Around 10% of municipalities	Vary, for detached houses: 49% have residual and food waste (dry recycling via bring), 25% have one residual waste bin (dry recycling via bring), 15% have multi compartment bins and 10% use a optibag system	All municipalities are required to provide collection for all household waste not covered by producer responsibility schemes. Collection systems vary between municipalities.	Batteries, WEEE, paper

4. Econometric Analysis

4.1 Method

The aim of this econometric analysis is to identify the policies that have had a significant impact on waste generation and recycling rates in the five countries with a sufficient time series of data available (as discussed in 1.2.1). The econometric models were developed using annual time series data across the countries.

The following two variables were used as the dependent variables in the econometric modelling:

- Waste generation; and
- Recycling rate.

While the data on waste generation was readily available, the data on recycling had significant gaps, and thus could not be used for the econometric model. Consequently, to construct the recycling rate variable for the model, the waste recycled was estimated by subtracting the waste incinerated and waste landfilled from the total waste generated. Although this would overestimate the recycling rates in these countries and reflect something more akin to "material collected for recycling", the overestimation is likely to be similar in all countries, and the overall analysis should be valid. This explains why the recycling rates used in this modelling vary from those reported elsewhere.

There were a number of waste related policies that have been implemented in these countries over time. The policies common to majority of the countries for which data were available, and thus included in the econometric model, were the following:

- Tax based policies:
  - Landfill tax;
  - Incineration tax; and
  - Packaging tax.

- Target based policies:
  - Landfill target;
  - Energy recovery target; and
  - Total recovery target (including energy recovery).
- Landfill bans:
  - Landfill ban on combustible waste; and
  - Landfill ban on organic/biodegradable waste.
- Deposit return schemes (DRS):
  - DRS on glass containers;
  - DRS on metal cans; and
  - DRS on plastic containers (small and large).
- Other economic instruments:
  - Pay-as-you-throw (PAYT) or charging schemes; and
  - Extended producer responsibility (EPR) regulations.

In the case of policies for which quantitative data was available (for example, tax rates, targets, deposit rates), these were used directly. Other policies were included in the model as indicator (or dummy) variables which take the value 1 for the periods when the respective policies were active, and 0 otherwise.

Besides the policy variables, the econometric model also included macroeconomic variables which would be likely to affect the waste generation and recycling rates. We have used the following macroeconomic variables in the model, for which the data were sourced from Eurostat:

- Population;
- Real GDP;
- Real household consumption.

We have estimated panel data regression models, as well as country specific regression models. Given the small number of data points per country (20 to 23 observations per country), the results from the panel data model are likely to more robust, compared to the results from the country specific regression model. Thus, the results from the country specific regression models should be interpreted carefully.

Another advantage of estimating the panel data regression model is that it is able to capture unobserved country specific characteristics (e.g. media campaigns on waste minimisation and recycling) that could affect waste generation and recycling rates in these countries.

The unobserved country specific characteristics in the panel data regression can be modelled either as random-effects (when the unobserved characteristics are uncorrelated with other dependent variables), or as fixed-effects (when they are correlated with other independent variables). We have estimated both random-effects and fixed-effects panel data model. Based on further statistical test on model specification, it was concluded that the fixed-effects model was more robust compared to the random-effects model for the current exercise.

The results from the fixed effects panel data models, as well as the country specific regression models are discussed below.

4.2 Summary of Waste Generation Results

Figure 31 presents trends in waste generation by country. Sweden generates the highest amount of waste, while Iceland generates the lowest. Although waste generation has increased over the years in all five countries, the rate of increase was highest for Sweden and Norway. On the other hand, Iceland displayed the most modest rate of increase.

Figure 31: Waste Generation

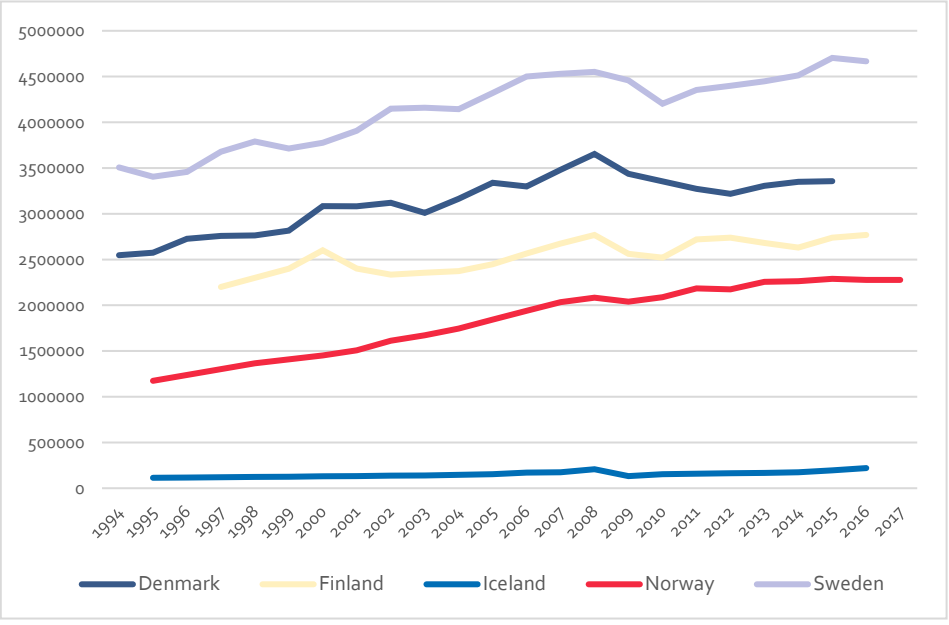
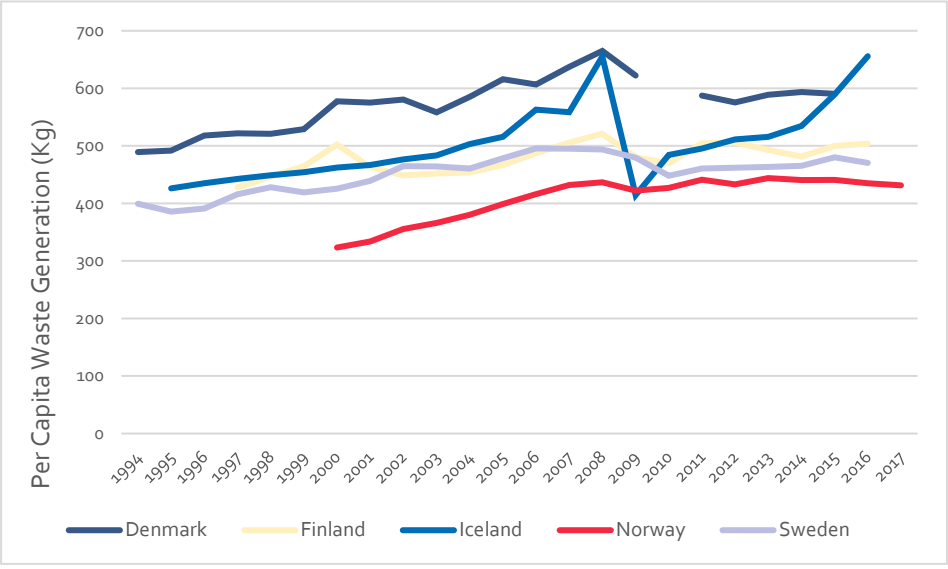


Figure 32, on the other hand, presents the per capita waste generation. It shows that Denmark has the highest per capita waste generation over the years (although Iceland had the highest level in 2016), and Norway has the lowest. Moreover, all of the countries except Iceland displayed an upward trend till 2008, and showed a constant or declining trend afterwards, which is a pattern seen in several other advanced economies in the EU over the same period.

Figure 32: Per Capita Waste Generation by Country



We discuss the panel data and country specific regression modelling results for waste generation in the following subsections.

4.2.1 Panel Data Regression Results

The fixed-effect panel data regression results for waste generation is presented in Table 16, where estimated coefficients along with the respective p-values (levels of significance) are provided for each policy.[109] The coefficients and associated p-values have been written in italics for the statistically insignificant policies.

Among the tax policies, the only statistically significant policy is the packaging tax (significant at 10%). Moreover, the coefficient is negative, implying that an increase in packaging tax would reduce waste generation.

Out of the 3 policies specifying targets, both total recovery target and energy recovery target are highly significant (at 1%), while the landfill target is not. Although recovery

[109] Estimated coefficients for macroeconomic variables, and country specific dummy variables are omitted.

(including energy recovery) targets should not be effecting waste generation directly, the significance could be explained by their effect through other policies (e.g. campaigns on reuse) that could not be included due to lack of data availability. It should also be noted that, while the coefficient of recovery target is negative (increase in recycling target would reduce waste generation), the coefficient of energy recovery target is positive (increase in energy recovery target would increase waste generation). This could be because there is not enough variation in data on energy recovery targets, with only Denmark having a separate energy recovery target.

It can also be observed that a landfill ban on combustible waste is significant (at 10%), while the landfill ban on biodegradable waste is not. However, the coefficient of landfill ban on combustible waste is positive, implying that introduction of a ban on landfilling combustible waste would increase waste generation.

Finally, none of the coefficients for deposit return schemes (DRS), Pay-as-you-throw (PAYT) and extended producer responsibility (EPR) regulations are significant.

Table 16: Panel Data Results for Waste Generation

Policy	Estimated Coefficient	p-value
Taxes		
Landfill tax	*268.37*	*0.815*
Incineration Tax	*49.678*	*0.951*
Packaging Tax	-80,502	0.098
Targets		
Recovery Target (%)	-251,827	0.001
Landfill target (%)	*-189,621*	*0.292*
Energy Recovery target (%)	853,833	0.000
Bans		
Landfill Ban on Combustible Waste	100,228	0.060
Landfill Ban on Biodegradable Waste	*-19,275*	*0.691*
Deposit Return Schemes		
Deposit amount for Glass containers	*11,935*	*0.971*
Deposit amount for Metal containers	*-23,737*	*0.911*
Deposit amount for Small Plastic containers	*-47,085*	*0.878*
Deposit amount for Large Plastic containers	*104,602*	*0.414*
Other Economic Instruments		
Pay-as-you-throw	*-52,894*	*0.256*
Extended Producer Responsibility	*4,107.5*	*0.880*

Note: The coefficients and associated p-values for the statistically insignificant policies are in italics.

4.2.2 *Individual Country Regression Results*

The results from the individual country regression for waste generation are presented in Table 17. Here we have presented whether a policy is statistically significant (green), or statistically insignificant (red), or indeterminate due to data unavailability/policy being in place before regression starting point (amber), along with direction of effect for significant policies (positive or negative). Grey highlighted cells denote the absence of that particular policy in the country in question.

It can be observed that two of the policies, landfill tax and DRS on large plastic containers, are significant for multiple countries. Landfill tax is significant for Finland and Norway, although the coefficients are negative for both countries, implying that an increase in landfill tax would increase waste generation. It should also be noted that the landfill tax is insignificant for Denmark and Sweden. DRS on large plastic containers is significant in Iceland and Norway, where the coefficients are negative for both countries. The negative coefficients could imply that producers are switching to lighter plastic containers from heavier glass containers because of DRS, thus reducing overall tonnage of waste generated.

Other policies which are significant in one country are:

- Landfill tax on hazardous waste (Denmark)
- Incineration Tax (Norway)
- Packaging tax (Iceland)
- Recycling Target (Sweden)
- Landfill target (Iceland)
- Landfill ban on combustible waste (Sweden)
- Deposit on glass containers (Finland)
- PAYT (Norway).

Interestingly, EPR is insignificant for all 5 countries, while both landfill ban on biodegradable waste and recovery target policies, are insignificant for 3 countries.

Table 17: Individual Country Regression for Waste Generation*

Policy	Denmark	Finland	Iceland	Norway	Sweden
Taxes					
Landfill tax		(+)		(+)	
Landfill tax on Hazardous Waste	(–)				
Incineration Tax				(+)	
Packaging Tax			(+)		
Targets					
Recovery Target (%)					(–)
Landfill target (%)			(+)		
Energy Recovery target (%)					
Bans					
Landfill Ban on Combustible Waste					(+)
Landfill Ban on Biodegradable Waste					
Deposit Return Schemes					
Deposit amount for Glass containers		(–)			
Deposit amount for Metal containers					
Deposit amount for Small Plastic containers					
Deposit amount for Large Plastic containers			(–)	(–)	
Other Economic Instruments					
Pay-as-you-throw				(–)	
Extended Producer Responsibility					

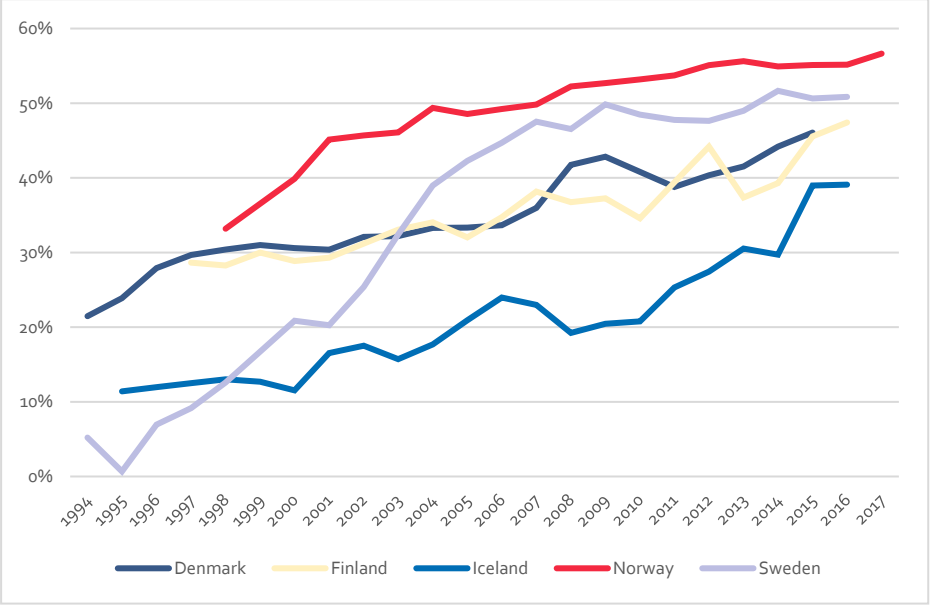
Note: * Level of significance 15%.

Green = policy is statistically significant. Red = statistically insignificant.
Amber = indeterminate due to data unavailability/policy being in place before regression starting point. Grey = absence of that particular policy in the country in question. Along with direction of effect for significant policies (positive or negative).

4.3 Summary of Recycling Rate Results

Figure 33 presents trends in the second dependent variable, recycling rate, by country. It can be observed that the recycling rate is Denmark was above the other countries throughout the entire period. On the other hand, the recycling rate in Iceland was below the recycling rates of the other countries almost for the entire period. Finally, while the recycling rates for all five countries have increased over time, the highest increased was observed for Sweden (from around 5% in 1994 to above 50% by 2014).

Figure 33: Estimated Recycling Rates by Country



We discuss the panel data and country specific regression modelling results for recycling rate in the following subsections.

4.3.1 *Panel Data Regression Results*

The fixed-effect panel data regression results for recycling rates are presented in Table 18, where estimated coefficients along with the respective p-values (levels of significance) are provided for each policy.[110] As before, the coefficients and associated p-values have been written in italics for the statistically insignificant policies.

Among the three tax policies, both landfill tax and packaging tax are significant. While the coefficient of landfill tax is positive as expected (increase in landfill tax should increase recycling rate), interestingly, the coefficient for packaging tax is negative. This could be due to packaging tax being correlated with other policies, such as EPR regulations, which is also highly significant (at 1%) with a positive coefficient (presence of EPR regulations would result in a higher recycling rate).

Out of the 3 policies specifying targets, both total recovery target and landfill target are highly significant (at 1%). However, both coefficients are showing unexpected signs. The coefficient of recovery target might be expected to be positive (higher recovery target should increase recycling rate), and the coefficient of landfill target should be negative (lowering the landfill target should increase recycling rate). A closer observation of the recovery targets of individual countries (Figure 34) reveals that there were little or no variation in recovery targets for Norway and Sweden, and Iceland didn't have a recovery target. So overall impact of recovery rate for the countries is negative. Similar conclusion can be drawn from an observation of the landfill targets for each country (Figure 35).

It can be observed that landfill bans on both combustible waste and biodegradable waste are highly significant (at 1% and 5%, respectively), with both coefficients positive as expected (introduction of landfill bans on combustible waste and biodegradable waste would increase recycling rates).

The coefficient of DRS for metal containers is significant (at 15%), and positive (increase in deposits for a material type would increase recycling of that material), while the coefficients of DRS for other materials were insignificant.

Finally, the coefficients of pay-as-you-throw (PAYT) is insignificant, but the coefficient of EPR is highly significant (at 1%), and positive, implying that introduction of EPR regulations would be likely to increase recycling rate.

[110] Estimated coefficients for macroeconomic variables, and country specific dummy variables are omitted.

Table 18: Panel Data Results for Recycling Rate

Policy	Estimated Coefficient	p-value
Taxes		
Landfill tax	0.00086	0.102
Incineration Tax	*-0.00003*	*0.938*
Packaging Tax	-0.04218	0.055
Targets		
Recovery Target (%)	-0.13359	0.000
Landfill target (%)	0.34080	0.000
Energy Recovery target (%)	*0.14287*	*0.165*
Bans		
Landfill Ban on Combustible Waste	0.06820	0.007
Landfill Ban on Biodegradable Waste	0.04464	0.043
Deposit Return Schemes		
Deposit amount for Glass containers	*0.12500*	*0.394*
Deposit amount for Metal containers	0.14962	0.131
Deposit amount for Small Plastic containers	*0.01293*	*0.925*
Deposit amount for Large Plastic containers	*0.01496*	*0.796*
Other Economic Instruments		
Pay-as-you-throw	*-0.00476*	*0.821*
Extended Producer Responsibility	0.07661	0.000

Note: The coefficients and associated p-values for the statistically insignificant policies are in italics.

Figure 34: Recovery Targets by Country

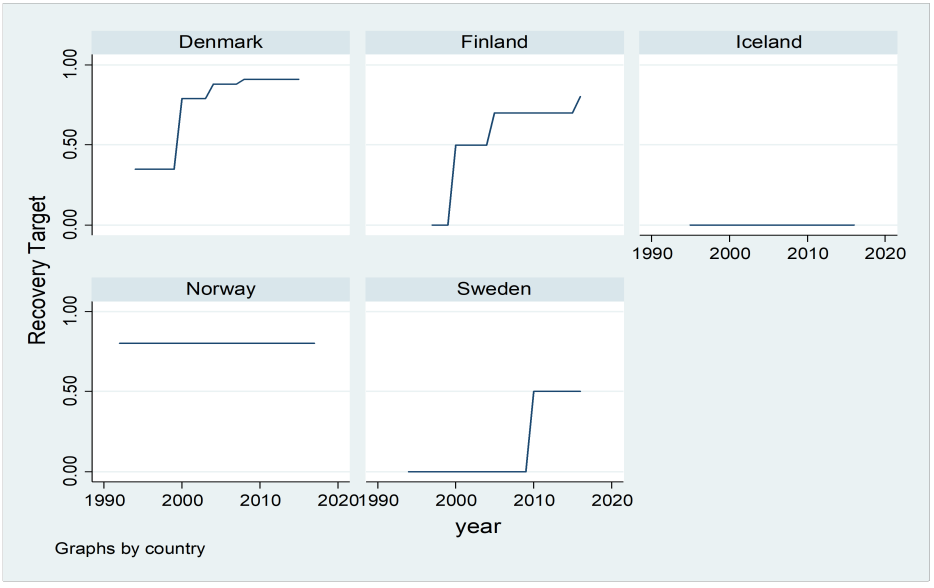
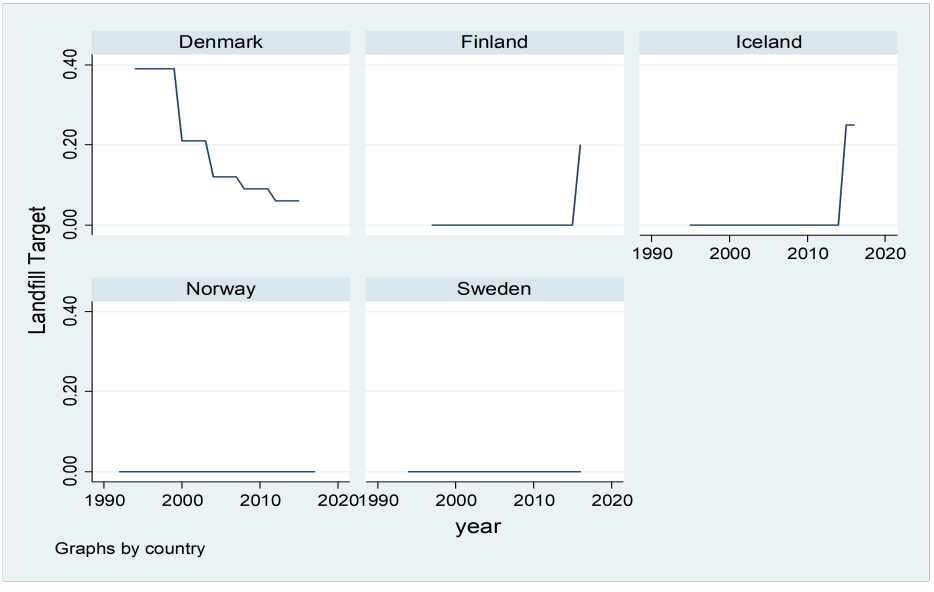


Figure 35: Landfill Target by Country



4.3.2 *Individual Country Regression Results*

The results from the individual country regression for recycling rate are presented in Table 19. As before, we have presented whether a policy statistically significant (green), or statistically insignificant (red), or indeterminate due to data unavailability/policy being in place before regression starting point (yellow), along with direction of effect for significant policies (positive or negative). Grey highlighted cells denote the absence of that particular policy in the country in question.

It can be observed that two of the policies, recovery target and landfill target are significant for multiple countries. The recovery target is significant for Denmark and Sweden, while the landfill target is significant for Denmark and Iceland. The signs of the coefficients of recovery target is negative for both countries, which is consistent with the negative sign of the coefficient for recovery target in the panel data regression model. While the coefficient for landfill target is negative for Denmark as expected, it is positive for Iceland. Figure 35 shows that the landfill target has steadily decreased for Denmark over the years while the recycling rate has increased (Figure 33). However, Iceland only introduced their landfill target in 2015, and it has not changed since, which could explain the positive relationship between their landfill target and recycling rate.

Other policies which are significant one of the countries are:

- Landfill tax on hazardous waste (Denmark);
- Landfill ban on combustible waste (Sweden);
- Landfill ban on biodegradable waste (Sweden);
- Deposit on metal containers (Iceland);
- Deposit on plastic containers (Norway);
- EPR (Sweden).

It should also be noted that the coefficients for landfill tax are insignificant for all four countries that have this policy (Denmark, Finland, Norway and Sweden) and that the coefficients for EPR are insignificant for three countries (Denmark, Finland and Iceland).

Table 19: Individual Country Regression of Recycling Rate*

Policy	Denmark	Finland	Iceland	Norway	Sweden
Taxes					
Landfill tax					
Landfill tax on Hazardous Waste	(–)				
Incineration Tax					
Packaging Tax					
Targets					
Recovery Target (%)	(–)				(–)
Landfill target (%)	(–)	??	(+)		
Energy Recovery target (%)					
Bans					
Landfill Ban on Combustible Waste					(+)
Landfill Ban on Biodegradable Waste					(+)
Deposit Return Schemes					
Deposit amount for Glass containers			(+)		
Deposit amount for Metal containers			(–)		
Deposit amount for Small Plastic containers					
Deposit amount for Large Plastic containers				(+)	
Other Economic Instruments					
Pay-as-you-throw					
Extended Producer Responsibility					(+)

Note: * Level of significance 15%.

Green = policy is statistically significant. Red = statistically insignificant. Amber = indeterminate due to data unavailability/policy being in place before regression starting point. Grey = absence of that particular policy in the country in question. Along with direction of effect for significant policies (positive or negative).

5. Policy Analysis and Recommendations

This section contains analysis of each of the main policy areas, drawing upon the econometric analysis, and then makes recommendations for future action.

5.1 Policy Analysis

This section provides some more detail on the policies in place and the conclusions from the econometric analysis. Whilst some country level analysis is presented in 4, the focus here is on the more robust panel data.

5.1.1 Residual Waste Taxes, Bans and Targets

Denmark, Åland, Finland and Sweden all have a landfill tax in place; Norway repealed its tax in 2015 and Iceland had planned to introduce one in 2016 but this has still not happened. All of these countries also have some level of ban on landfilling of biodegradable and/or combustible waste. Whilst from the individual country graphs and data it appears that these policies have been effective at reducing the amount of residual waste to landfill, the panel data from the econometric analysis provides a more focused analysis. Looking at the panel data for waste generation, neither the tax or a ban on biodegradable waste to landfill is shown to have a significant effect. A ban on combustible waste to landfill shows a positive correlation (i.e. an increase in waste generation), indicating these policies are not decreasing waste generation. Looking at the panel data for recycling rate a landfill tax and both types of landfill ban (combustible and biodegradable) are shown to have a significant effect on recycling rate.

Whilst not specifically analysed, from the country data a notable effect of landfill bans and taxes seems to have been to move waste towards incineration, including investment in incineration capacity in order to provide an alternative treatment route

for mixed residual waste which is not subject to a tax and/or a ban. Interestingly, Greenland, which does not have a landfill tax or landfill ban on biodegradable waste in place is still seeing a switch towards incineration (71% household waste was incinerated in 2015). However, for Iceland, which is in the same position of not having a landfill tax or ban at present, residual waste treatment is still dominated by landfilling rather than incineration. The specific issues in respect of this are discussed in the country challenges.

The desired effect of banning landfilling of biodegradable waste may be to increase the separate collection of biowaste, and the three countries with a ban on the landfilling of biodegradable waste are those with the highest level of separate collection of biowaste: Sweden (77%), Norway (70%) and Finland (44%). Having said that, Finland estimated the net increase in separately collected biowaste as a result of the ban on landfilling biodegradable waste (implemented in 2016) to be 2% by 2020, which does not sound highly significant.

There has been some use of incineration taxes across the Nordic countries. Sweden used a climate tax on incineration, which applied a tax per kg of CO_2 emitted from waste incineration. This is quite different to incineration tax on a per tonne basis of material incinerated that is present in other countries. This was in place 2006–2010 but repealed due to its being considered ineffective at increasing recycling rates.[111] The possibility of an incineration tax for Sweden is once again being considered, with plans for a tax of SEK 100 (EUR 10.2) per tonne of waste from 2020 subject to ongoing consideration. However, with landfill tax at 49 EUR/tonne, the scale of the tax being imposed seems unlikely to be as effective at initiating a major shift in treatment as the earlier landfill tax.

In Norway an incineration tax was in place for 11 years until 2010 at a level of around EUR 10–15, but was dropped shortly after Sweden repealed its incineration tax due to the extent of waste being transported across the border to Sweden to avoid the tax. There is a substantial and important market for imported and exported waste as Refuse Derived Fuel (RDF) for incineration, with particularly significant movement of RDF between Norway, Sweden and Denmark. Caution should be taken around introducing incineration taxes to ensure that the tax cannot be avoided by exporting.

The incineration tax in Denmark is structured such that it is cheaper (44 EUR/tonne 2017) to incinerate than to landfill (51 EUR/tonne 2017), there is an additional tax on

[111] https://www.wastematters.eu/uploads/media/DWMA_Svenska_avfall.pdf

heat produced from waste (EUR 6.19/MWh) but it is still significantly cheaper to incinerate than landfill. Despite the tax in place, incineration is still the treatment route for >50% of household waste. The panel analysis has not shown any significant effect of the presence of an incineration tax on either waste arisings or recycling rate.

Denmark, Iceland and Åland have all used specific targets for the levels of residual waste to incineration and/or landfill. For Denmark and Åland these are outlined within national Waste Plans indicating the targets for recycling, incineration and landfill. For Åland the target is for Recycling 60%, Incineration 30% and Landfill 10% by 2020 and for Denmark Recycling 50%, Incineration 46% and Landfill 4% by 2022.[112] For Iceland the 2016–2028 waste management plan specifies landfill shall not exceed 25% of waste generated. The use of an energy recovery target, whilst only analysed for Denmark, shows a positive correlation with waste arisings, indicating an increase in waste arisings. As such it is found to be ineffective in changing arisings, which seems logical given the intended effect is a change in treatment route.

Whilst the scope of the econometric analysis focuses upon the effect on recycling and waste prevention, it does appear that landfill taxes and bans have, on the whole, been successful in removing mixed household waste from landfill, with the consequent benefit of reducing the greenhouse gas emissions associated with biowaste decomposing in landfill. Where the heat and electricity generated from incineration is offsetting fossil fuel sources again there are positive environmental impacts from this switch. Going forward, for Nordic countries where incineration is the primary source of residual waste treatment and as the energy mix for heat and power is decarbonised through growth in renewables, the marginal offset becomes progressively less beneficial.

5.1.2 Recycling and Recovery Targets

All EU countries have been bound for many years to the overall recycling targets which have been set by the European Union, including a 50% target for the recycling of municipal waste by 2020. Those setting targets beyond this include Åland with 60% target by 2020 and Finland with 55% by 2023, contained within national waste management plans. Recovery targets, which include a target for the amount recycled

[112] These targets were within the 2015 plan and not updated within the most recent plan.

and recovered through waste to energy, showed in the panel data of the econometric analysis to be significant both for reducing arisings and increasing recycling rate. In addition to Denmark, Finland and Åland's overall recycling and recovery targets as outline above, Norway has a target of 80% (since 1991) and Sweden has had a 50% recycling rate target in national waste plan since 2005. Whilst these are not being met in many cases, particularly for the recycling targets (as indicated by Figure 2), they are showing a move in the right direction for waste generation and recycling rates, albeit rates of increase are often relatively low.

The cascading of targets down to individual municipalities has generally not been done, which does limit the effectiveness of recycling targets, since it is generally at a municipality level where there is most power to change collection systems to increase recycling rates. With the much higher EU targets under the revised waste directives that came into force in 2018, new methods for significantly increasing performance will be required and these may include the passing down of targets to regional or local level.

5.1.3 Material Taxes

Raw Material Tax

A raw materials tax can be used to reflect the different environmental costs involved in primary production of a material, rather than using a secondary or recycled source or ideally reducing use of that raw material altogether. Only Denmark has a tax in place for raw materials, which has been in place since 1990. However, it applies to only a limited number of materials that are actually extracted in Denmark (gravel, stone, clay and chalk), which are not included within the scope of municipal waste. Although it was not possible to carry out analysis with the data available, anecdotal evidence suggests that the tax led to a significant increase in recycled construction and demolition waste, with recycling rates rising from 12% in 1985 to 94% in 2004.[113]

Packaging Tax

Finland, Iceland, Denmark and Norway all have packaging taxes in place in some form. All of these packaging taxes focus on beverage packaging, although Denmark's does cover other non-packaging disposable items such as bags, cutlery and plates under the same tax.

[113] European Commission (2011) Taxes on natural resources reduce use of raw materials.

Looking at the panel data, the use of the packaging tax correlates with a reduction in waste arisings, indicating that an increase in packaging tax reduces waste generation. As such, it appears that this policy has been effective in achieving a degree of waste prevention.

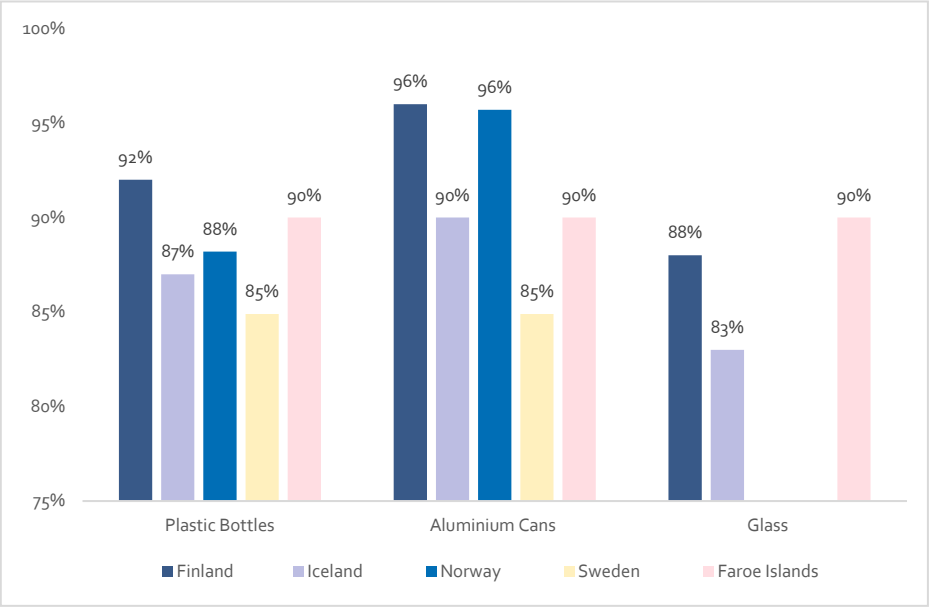
5.1.4 Extended Producer Responsibility

Every country except Greenland has some level of producer responsibility policy. Commonly covered items are WEEE, End of Life Vehicles, packaging, and batteries. The econometric analysis does not show that EPR policies in their current form are significantly effective at increasing recycling or reducing arisings. For some countries the streams covered are relatively minor to the overall waste arisings and so in those cases it may be logical to expect that these do not result in significant changes to recycling rates. However, in countries that have well-developed producer responsibility systems for packaging, one would expect to see a more significant effect from recycling as a result. Considerable reform of producer responsibility systems will be required in most of the region as a result of the 2018 revisions to the Waste Framework Directive and Packaging and Packaging Waste Directive and this may help to make producer responsibility systems more decisively effective in increasing recycling rates and reducing waste.

All the Nordic countries have some form of deposit return scheme (DRS) for beverage packaging and the most recent reported return rates are shown in Figure 36. A return rate was not available for Greenland's system, and for the Faroese system, only an average return rate of 90% across all materials was available.

These capture rates are above what is generally achieved by other collection methods in Nordic countries and therefore can be considered a successful way to capture the material streams that are covered. For Greenland, the DRS covers only West Greenland; however, this is where the majority of the population is concentrated. Both Greenland and Iceland landfill some of the collected packaging, as domestic recycling markets do not exist for these streams. This is a potential opportunity for these countries to increase their recycling rates as the materials collected from DRS are likely to be relatively pure, with less contamination than that collected via other systems. The panel data shows only the DRS on metal containers to be significant in increasing recycling rates. Metal packaging does have the highest reported return rate (Figure 36), but one would expect the impact of DRS to be similar across other materials (such as plastic bottles) where much higher capture rates are reported than for other collection methods.

Figure 36: Reported Return Rates by Material for Nordic Deposit Return Systems



5.1.5 *Waste Management Charges*

Across the Nordic countries there is limited use of weight-based "pay as you throw" systems (PAYT), generally accepted as being the most effective PAYT systems. Most variable charging structures for residual waste are related to volume of container, frequency of collection (weekly, fortnightly etc.) or charged per lift. Since the use of PAYT systems is variable within countries, and for many has been in place for a long time, the econometric analysis does not show it to have a significant effect on waste arisings or recycling rate. Evidence from elsewhere suggests that if implemented well, PAYT can be effective. For example, all countries with recycling rates above 45% employ a similar system [to PAYT], while most countries with recycling rates below 20% do not use them.[114] Whilst the concept of PAYT as a usage priced model for waste

[114] *Municipal waste management across European countries*. European Environment Agency. 16 November 2016 https://www.kidv.nl/6845/eea-municipal-waste-management-across-european-countries.pdf

management is supported by few specific drivers within EU legislation, it has been successfully implemented in many regions across Europe, including in Switzerland, Germany,[115] the north of Italy and the Netherlands, with examples of introduction in the cities of Berlin, Brussels, Munich and Vienna.[116] Given the presence of a user-charging structure for municipal waste management within the Nordic countries, there does appear to be potential for more use of PAYT. If using a weight-based system, this may be most effective if combined with frequency-based component. The combination of weight and frequency-based system overcomes density issues by increasing capture of low bulk density materials, notably plastic packaging.[117]

5.1.6 Approach to Collections

Nordic countries have often relied upon "bring bank" type systems for recycling where residents deliver recycling to a central recycling point rather than receiving door-to-door collection. There has been a significant increase in door-to-door collection over the past decade, but most households still rely on bring banks for some materials.

Mixed (residual) waste collections are typically door-to-door. Even in countries where the infrastructure for waste management is less well developed, such as Greenland, regular door-to-door collections of mixed waste are used. Some Nordic countries are in a phase of rapid growth in door-to-door recycling and biowaste collections, recognising that this can increase recycling rate by increasing the convenience of recycling. Where information is available, as might be expected, generally countries with more door-to-door collections and with a wider range of materials covered have higher recycling rates.

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[115] Waste Management World (2005) *Pay as you throw - Options, economics and prospects across Europe*, https://waste-management-world.com/a/pay-as-you-throw

[116] Agencia de Residus de Catalunya (2010) *Guide for the Implementation of Pay-As-You-Throw Systems for Municipal Waste PAYT*, November 2010, http://residus.gencat.cat/web/.content/home/lagencia/publicacions/centre_catala_del_reciclatge__ccr/guia_pxg_en.pdf

[117] Eunomia Research & Consulting (2006) *Modelling the Impact of Household Charging for Waste in England, Report for the Department for Environment, Food and Rural Affairs*, December 2006, http://archive.defra.gov.uk/environment/waste/strategy/incentives/documents/wasteincentives-research-0507.pdf

Separate Collection Schemes for Biowaste

Åland, Denmark, Finland, Norway and Sweden all have some level of separate biowaste collections and Greenland has trialled pilot schemes for collection of biowaste in some municipalities. Where coverage is known, these vary from 36% of households in Denmark to 77% in Sweden. All the countries with the highest levels of recycling have some level of separate biowaste collections. The use of separate biowaste collection is clearly an effective way to increase recycling rates given the proportion of the waste stream comprising of biowaste, shown wherever waste composition is available for countries. The proportions of biowaste in residual waste composition is high even where there is some level of separate collection of biowaste, and separate collection of biowaste has not been mandated by any Nordic country. The strong indication is that there is significant potential to increase the recycling of biowaste and it will clearly be crucial to achieving much higher overall recycling rates for separate collection and capture of biowaste to increase dramatically.

5.1.7 Grants

The effectiveness of grants is difficult to analyse. For many countries grants are used during the early stages of making structural changes in a waste management system. For many of the Nordic countries advanced waste management systems already exist, and current funding programmes are focused on more "innovative" waste management schemes and moving towards a circular economy. Notable funds within the Nordic countries include:

- *Denmark* funding for the national waste strategy to support pilot schemes trialling various measures in municipalities. The Danish EPA funded to the level of DKK 200 mn (~EUR 27 mn) over the period of 2013–2017;
- *Greenland's* 2015 waste management plan granted DKK 1–3 million per annum (EUR ~130,000–400,000) to look at gaining experience in waste minimisation, composting, recycling of waste fractions, transport of waste between villages and optimisation of the operating system:
  - This has recently been succeeded by the introduction of Greenland's Environmental Fund in January 2019. The fund draws resources from the revenues of environmental taxes and also from the treasury budget and

allocates them to improving Greenland's waste management facilities through upgrading of existing incinerators and landfills, and through development of new facilities;

- The Act continues Greenland's provision of grants, stating that grants may be awarded for local environmental consultants working with municipalities to implement pilot projects, similar to those under the 2015 Plan for the Waste Sector.

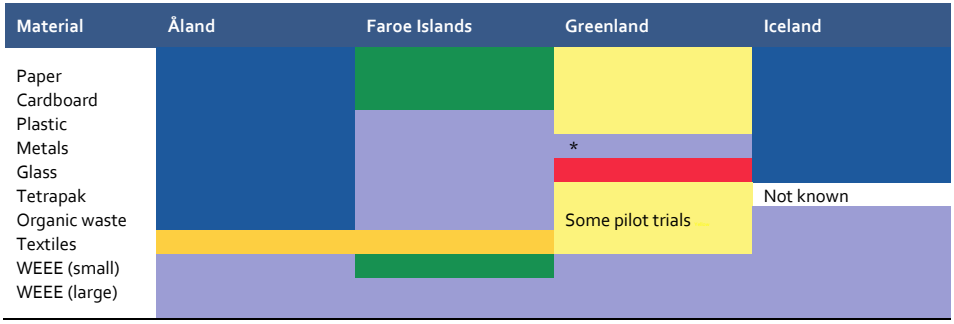
5.2 Key Challenges

From the individual country profiles there are a number of common themes in terms of challenges facing the Nordic countries, which to a greater or lesser extent influence the future recommendations. The themes are summarised here.

5.2.1 Island nations

The more isolated islands including Greenland, Iceland and the Faroe Islands face specific challenges around a lack of national infrastructure and reliance on transporting materials, often long distances to treatment / markets, and recycling rates are generally poor compared to the other Nordic nations (33% and 16%, for Iceland and the Faroe Islands respectively). To some extent Åland has similar challenges but given its proximity to mainland Finland and Sweden these challenges are less pronounced. A summary of the coverage of systems is shown in Table 20 indicating the gaps in current collection systems.

Table 20: Coverage of recyclable materials by Island nations and Key



Note: * Greenland has some collections of scrap metal which is exported for recycling.

Red = Partial coverage with household collection. Green = Household Collection.
Blue = Mix of household collection and bring schemes. Violet = Bring Scheme.
Amber = Private Scheme. Yellow = No collection.

Source: Adapted from COWI (2017) Waste Management in Small Communities - Suggestions for Improvement, 2017, and including information from the country profiles for each of these island nations.

Infrastructure Capacity

As noted specifically in several of the country profiles, there is a capacity or planned capacity for incineration which is not in alignment with the EU's revised recycling targets. This may leave those countries dependant on imports of waste for incineration if recycling targets are to be met and the low cost of incineration in some countries may act as a disincentive to meeting those recycling targets in the first place.

Additionally, for many countries there is insufficient capacity for reprocessing recyclables and treating biowaste. Arguably the lack of indigenous recycling capacity is less of an issue providing there are readily available international markets available for dry recycling. However, this is not always the case and it seems clear the Europe will need to become more self-sufficient in reprocessing capacity, developing more close-loop systems for key materials, if the EU's recycling aspirations are to be met. In the case of biowaste, which still arises in high concentrations in mixed residual waste across all Nordic countries, increased local processing capacity will clearly be needed.

Rurality/Geographic and Climatic Issues

Many of the Nordic countries have a high proportion of population in rural areas, for which an efficient waste management system can be more challenging to deliver. This

influences a lower coverage of separate door-to-door collections for recycling. Additionally, for some Nordic countries particularly extreme winter weather conditions make collections problematic. However, the need to reach high recycling rates that are likely to be unachievable by relying on "bring" collections will mean that these issues of rurality and climate will need to be overcome for all but the most extreme locations.

5.3 Future Challenges

Whilst the major focus of this work has been a historical "backward look" at the impact of waste management and policy approaches on generation of waste, performance in recycling and other metrics, this section takes a brief look at future requirements. Major updates were made to the EU waste directives in 2018, which impact substantially on requirements for Member States with respect to their waste management performance and systems. This included updates to the WFD (2008/98/EC), the LFD (1999/31/EC) and the PPWD (94/62/EC) as well as the proposal of the draft SUPD.[118,119,120,121]

The key changes to these Directives are shown in Table 21, Table 22 and Table 23 with explanatory text in Section 5.3.1. This matrix looks to demonstrate how the performance of the Nordic countries, who are all either members of the EU or EEA, compares to the requirements which will come into force. One key point here is that the change in measurement method of recycling will apply to achievement of targets from 2025 and as such, current recycling performance is likely to be overstated against that new metric and may not be a good guide as to the gap to be covered to achieve the new targets.

The matrix is colour coded to demonstrate whether the target or requirement is likely to be achieved within the existing framework (green), whether there is progress towards achieving the target/requirement (amber), or whether the target/requirement

[118] (2018) Directive (EU) 2018/850 of the European Parliament and of the Council of 30 May 2018 amending Directive 1999/31/EC on the landfill of waste (Text with EEA relevance), 150.

[119] (2018) Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste, Official Journal of the European Union.

[120] European Parliament and the Council of the European Union (2015) Directive (EU) 2015/720 of the European Parliament and of the Council of 29 April 2015 amending Directive 94/62/EC as regards reducing the consumption of lightweight plastic carrier bags.

[121] European Commission - PRESS RELEASES - Press release - Single-use plastics: New EU rules to reduce marine litter, accessed 24 September 2018, http://europa.eu/rapid/press-release_IP-18-3927_en.htm

is unlikely to be met without significant change (red). For requirements where it is unclear as to the extent a country will meet the requirement, a red dashed pattern is displayed. This is the case largely for the change to the recycling measurement method, as countries are not yet required to comply and the details of the new method are not yet known, and thus adoption of the change remains to be seen. An exception to this is Finland, whose current calculation of recycling performance aligns more closely with the new method. The matrix containing the requirements for the draft SUPD is in a darker colour as these requirements are draft measures at this stage and are not yet fully agreed.

Table 21: Gap Analysis of Nordic EU and EEA Members Performance against Waste Framework Directive (2018) Requirements

Country	Waste Framework Directive (2018 amds)									
	Definition of Municipal Waste	EPR Requirements	Separate Collections	2020 – 50% recycling target	2025 – 55% recycling target	2030 – 60% recycling target	Change to Measurement Method	Biowaste Collections - separate collection or recycling at source by 2023	Separate Collection of Textiles by 2025	Separate Collection of Hazardous Waste by 2025
	Article 3	Article 8a	Article 10	Article 11			Article 11a	Article 22	Article 11 (1)	Article 20
Denmark				47,7%						
Finland				42,0%						
Iceland				33,2%				0%		
Norway				38,2%						
Sweden				48,9%				73%		

Note: Against Article 11, the most recent recycling rate for municipal waste as reported to Eurostat is shown. Against Article 22, the current coverage of biowaste collections is shown. Against Article 6(1), the most recent recycling rate for packaging waste as reported to Eurostat is shown. The ranking of countries status against achieving the requirements for these articles is based on these reported current rates.[1, 2]

Green = On track for requirement/requirement achieved. Amber = Progress made towards achieving requirement. Orange = Requirement will not be achieved on current trajectory. Red = Not known.

Source: [1] Recycling rate of municipal waste – Eurostat, accessed 7 November 2018, https://ec.europa.eu/eurostat/web/products-datasets/product?code=sdg_11_60
[2] Recycling rates for packaging waste – Eurostat, accessed 7 November 2018, https://ec.europa.eu/eurostat/web/products-datasets/product?code=tenoo063

Table 22: Gap Analysis of Nordic EU and EEA Members Performance against Landfill Directive (2018 amds) and Packaging and Packaging Waste Directive (2018 amds)

Country	Landfill Directive (2018 amds)	Packaging and Packaging Waste Directive (2018 amds)			
	Landfill cap at 10% of Municipal Waste by 2035	2025 – 65% recycling all packaging	2030 – 70% recycling all packaging	Consumption targets for plastic carrier bags	EPR for all packaging streams in accordance with 8a of WFD
	Article 5 (5)	Article 6 (1)	Article 6 (1)	Article 4 (1a)	Article 7 (2)
Denmark	1,0%	79,0%			
Finland	3,3%	64,7%			
Iceland	57%	51,6%			
Norway	4,2%	57,2%			
Sweden	0,6%	68,2%			

Note: Green = On track for requirement/requirement achieved. Amber = Progress made towards achieving requirement. Orange = Requirement will not be achieved on current trajectory. Red = Not known.

Table 23: Gap Analysis of Nordic EU and EEA Members Performance against Single Use Plastics (Draft) Directive

Country	Single Use Plastics (Draft) Directive		
	Market restriction for certain items	EPR for SUP items	90% collection (potential to be amended to recycling) of beverage bottles
	Article 5, Annex Part B	Article 8(1), 8(2), Annex Part E	Article 9(a)
Denmark			90,0%
Finland			92,0%
Iceland			87,0%
Norway			88,2%
Sweden			84,9%

Note: Percentages shown against Article 9(a) are the most recent return rates for plastic bottles achieved by the deposit refund systems in the respective countries.[1]

Green = On track for requirement/requirement achieved. Amber = Progress made towards achieving requirement. Orange = Requirement will not be achieved on current trajectory. Red = Not known.

Source: [1] Reloop, and CM Consulting (2018) Deposit Systems for One Way Beverage Containers: A Global Overview, 2018, https://reloopplatform.eu/wp-content/uploads/2018/05/BOOK-Deposit-Global-27-APR2018.pdf

5.3.1 *Future Challenges and Gap Analysis – Summary*

Municipal Waste Targets

The recycling targets introduced under the changes to the Directives are challenging, and significantly more so because of the new measurement method. The measurement point for most materials in all Nordic countries will shift significantly further into the recycling process. For example, plastic packaging is generally currently counted as recycled when it leaves the initial sorting process (e.g. when it has been sorted by polymer and colour) or even at the point of collection. This will move to the point of flaking or even post-washing of flaked plastic material. As a consequence, a considerable amount of packaging contents, labels and external dirt and contaminants that are routinely counted as "recycled plastic" will no longer be counted. These new measurement points, intended to measure "actual recycling", are highly likely to cause current reported recycling rates to fall for many materials and therefore make the gap to reaching the new targets significantly larger. The change in measurement method makes even the 55% target quite challenging for all of the Nordic countries, with the later targets up to 65% by 2035 being very challenging indeed.

The capture rates necessary to meet the high recycling targets are likely to mean that door-to-door collection will have to be rolled out everywhere that it can reasonably be reached by such systems. In addition, public participation will need to be very high – both in term of the proportion of the population that separate their waste and the extent to which they separate it, covering every readily recyclable material.

Within this, capture of biowaste, especially food waste, will be vitally important due to the large amount still in mixed residual waste at present.

Mechanical sorting technology is improving steadily and the Nordic nations are leaders in the development and use of this technology, but in anything like its current form it can only contribute a certain amount. In particular, to reach very high recycling rates, losses of target material have to be kept to an absolute minimum. Current state of the art sorting technology has reached the point where it can deliver streams of high-quality material with limited contamination, but to achieve this, losses of some target materials are unavoidable. As such, based on current and emerging technology, collection of materials separately, with reliance upon sorting technology perhaps focused on the sorting materials for recycling from mixed residual waste seems like a sensible approach.

Cascading targets down to the regional or local level has been a powerful tool in many countries but is not practiced in the Nordic countries. In order to go down this route, it would be necessary to ensure that split responsibilities, particularly between producer responsibility organisations and municipalities, do not undermine the cascading down of targets to the local level.

Extended Producer Responsibility

Article 8a will require significant reform of packaging EPR and some other EPR schemes in all EU Member States and in EEA member countries. These changes will be challenging in many cases, but also represent an opportunity to address limitations in effectiveness of existing schemes. A full review of the updates to the requirements is not provided in this section. However, there are important new requirements regarding the costs which producers must cover in all EPR schemes.

Article 8a sets out which specific costs the producer should be responsible for; these are:

- "costs of separate collection of waste and its subsequent transport and treatment, including treatment necessary to meet the *Union waste management targets*, and costs necessary to meet other targets and objectives[122]…taking into account the revenues from re-use, from sales of secondary raw material from its products and from unclaimed deposit fees" (emphasis added)
- "costs of providing adequate information to waste holders…"
- "costs of data gathering and reporting…"

These costs suggest that a "full cost recovery" approach will be required by Member States to fulfil the obligation of any EPR scheme that is implemented. The European Commission will be publishing guidance later in 2019 regarding the precise expectations on scheme design, but it does seem clear that the principle of full cost coverage has been given significantly more emphasis in the new Directives.

[122] Union Objectives refers to objectives listed in 8a (1b) which references the targets of the Packaging and Packaging waste Directive (94/62/EC), the End of Life Vehicles Directive (2000/53/EC), the batteries Directive (2006/66/EC), and the WEEE Directive (2012/19/EU).

Importantly, as emphasised above, it seems that this "full cost" will not be restricted to meeting targets relating only to the particular material stream in question (e.g. packaging), but rather will encompass all relevant EU targets (e.g. also those relating to total municipal waste). The draft SUPD takes this principle a lot further, with a suggestion that full cost coverage EPR would also apply to the cost of managing some single use plastics in litter.

Packaging Targets

The updates to the PPWD set higher targets for recycling of packaging as a whole, and also set higher material specific targets for packaging streams. These are shown in Table 21. The gap analysis lists each country's latest reported recycling rate for packaging waste against the overall packaging recycling target.

However, it should be noted that the revised measurement method for recycling will also apply to packaging waste and so existing reported performance seems likely to decline for at least some materials (e.g. perhaps significantly for plastics).

Table 24: Packaging Recycling Targets in the PPWD

Material	2025	2030
All Packaging	65%	70%
Plastic	50%	55%
Wood	25%	30%
Ferrous Metals	70%	80%
Aluminium	50%	60%
Glass	70%	75%
Paper and Cardboard	75%	85%

In terms of plastic packaging, Sweden currently reports a 50.7% recycling rate for plastic packaging, Norway 44.6%, Iceland 42.7%, Denmark 36.1%, and Finland 25.4%. However, as noted above, these future targets will need to be achieved against the new measurement method for recycling. Finland's measurement method is similar to this, and could explain its reported lower performance for plastic packaging compared to the other countries.

In addition to the increased targets, full cost coverage in the context of the revised targets (WFD and well as PPWD) and change to measurement method will mean producers in most, if not all, of the Nordic EU Member States/EEA members paying significantly more towards the cost of compliance. This will be considerably greater still if anything like the current draft SUPD litter provisions become law.

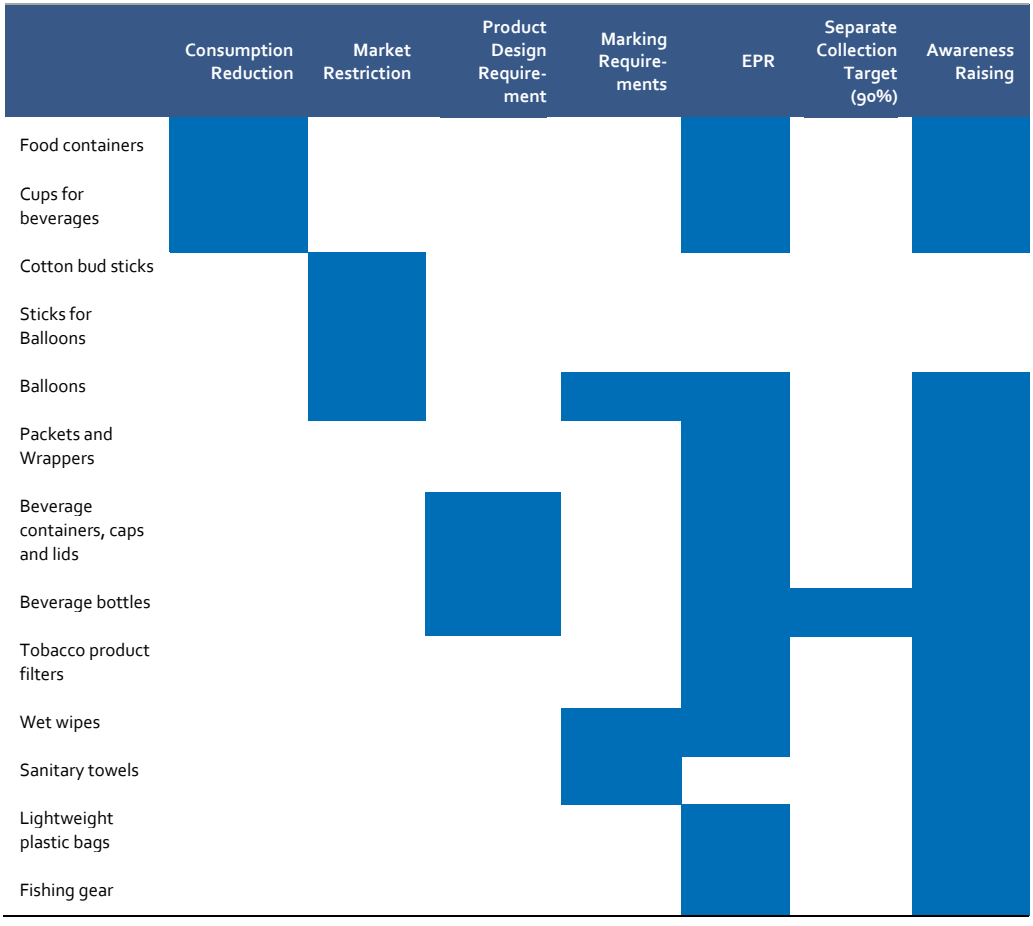
This is likely to be unpopular with producers and may present significant political challenges. However, it also presents opportunities. Greater system integration will be necessary in order to cost-effectively meet the more challenging targets that producers will be responsible for and producers will also have a significant interest in ensuring that the stability of secondary materials markets improves.

Many producers, especially the major global brand owners, are now making their own commitments that will entail systemic change and increased investment. Producers are increasingly prepared to engage and invest, but they will want to see an efficient system that sees them only contributing the necessary cost.

The Draft Single Use Plastics Directive

A summary table of the requirements under the draft SUPD is shown in Table 22.

Table 25: Table to Summarise Proposed Measures in the Draft SUPD



Note: Blue = Measure proposed for product.

The requirements for EPR under the draft SUPD differ from those in the WFD, requiring that schemes cover the full cost of waste management *including litter*. The wording is as follows:

> "Member States shall ensure that the producers of the single-use plastic products listed in Part E of the Annex [all products identified for EPR in Table 21], shall cover the costs of the collection of waste consisting of those single-use plastic products and its subsequent transport and treatment, *including the costs to clean up litter* and the costs of the awareness raising measures referred to in Article 10 regarding those products."

In this way the six plastic packaging product groups targeted by the draft SUPD that were already subject to a requirement for EPR to be introduced by 2024 (under the PPWD), must also be responsible for the costs of litter clean up. The costs of litter clean up may be difficult to quantify and are not covered by current schemes. Hence, there will be work to be done across all the EU and EEA Member Nordic countries, and this is shown against this requirement in Figure 38.

By contrast, it does not seem as though the Nordic countries which are EU or EEA Members would struggle too badly to meet the proposed 90% target for plastic beverage bottle collection. At present, they all have deposit return systems in place which achieve levels close to if not above 90% collection. However, there is proposal to amend this requirement to 90% recycling of plastic beverage bottles to be coherent with the updated measurement method in the WFD and this may be more challenging.

Cross Cutting Issues: Plastics

Plastics are the issue of the moment in waste and recycling policy, and this is reflected in the planned changes to the Directives, the Plastics Strategy and with the draft SUPD. The requirements of the draft SUPD are shown in Table 22.

In addition to this, the Plastics Strategy gives further indication of the direction of travel for EU policy. It was communicated by the Commission in January 2018, with the aim for Europe to lead the transition towards the sustainable use of plastics.[123] The strategy recognises the importance of plastics as a resource, and the insufficiency of the current approach to their recycling and reuse. However, the strategy does not set quantitative targets per se, more so giving a suggestion of the direction for future policy and regulation.

Between the plastic packaging recycling targets of the PPWD, the change to measurement method for recycling and the new requirements for EPR schemes under Article 8a and the draft SUPD, it is clear that Europe envisages an ambitious policy future

[123] European Commission (2018) *EU Leading Global Action to Protect the Planet*, 2018.

with respect to plastics. As such, it is clear that major changes will need to be made to the management of plastics (including single use plastics) in future Nordic policy if the draft SUPD is agreed, and under the updates to the PPWD which have been agreed.

Cross Cutting Issues: Uptake of Secondary Materials[124]

One issue of note looking forward is that of the use of secondary materials, or recycled content. Increasing recycling targets will continue to push a greater quantity of material into recycling processes. However, there is concern that there are insufficient "pull" measures in place to ensure that this secondary material undergoes high quality recycling in closed loop or "material to material" processes, and that there is demand for its use. A number of policies hint at measures which would look to encourage the use of recycled content, and the Plastics Strategy launched a voluntary pledging exercise to increase the use of so-called secondary materials.[125]

The relevant wording of the Plastics Strategy is as follows:

> "The Commission is launching an EU-wide pledging campaign to ensure that by 2025, *ten million tonnes of recycled plastics* find their way into new products on the EU market. To achieve swift, tangible results, this exercise is addressed to both private and public actors, inviting them to come forward with substantive pledges by June 2018."

Launched in 2018, this pledging exercise was due to be completed in October and it would be of interest to understand the impact it has had. However, the results of the campaign are not yet available. One concern with this pledging exercise was that it lacked any requirements on quality of the destinations for the recycled plastics. A pledge may commit to incorporating a given amount of recycled content into a new product, but if it displaces a non-plastic, such as plastic recycled into a plastic-wood substitute then a considerably smaller environmental benefit is achieved.

Other places in future EU policy where it seems as though measures could be incorporated around recycled content are lacking them. There is nothing relating to recycled content in the new EPR requirements under Article 8a of the WFD, although updates to Article 8(2) do discuss design to reduce waste generation and environmental

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[124] Eunomia will shortly be releasing a report in conjunction with the Resource Association and WWF-UK, analysing policy options for increasing use of post-consumer recycled materials.

[125] European Commission (2018) *A European Strategy for Plastics in a Circular Economy*, January 2018, http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1516265440535&uri=COM:2018:28:FIN

impacts with mention of recycled materials. However, there are no requirements for Member States to take action in this respect as yet.

The wording is as follows:

> "Such *measures may encourage*, inter alia, the development, production and marketing of products and components of products that are suitable for multiple use, *that contain recycled materials*, that are technically durable and easily reparable and that are, after having become waste, suitable for preparing for re-use and recycling in order to facilitate proper implementation of the waste hierarchy. The measures shall take into account the impact of products throughout their life cycle, the waste hierarchy and, where appropriate, the potential for multiple recycling."

In addition, there are no current recycled content targets in any of the current legislation. A revision of the draft SUPD by the Parliament contains a proposed requirement for recycled content incorporation in beverage bottles. This requirement was not in the original proposed text of the draft Directive, and was added as an amendment. The wording of the requirement is:

> "Member States shall ensure that by 2025 *beverage bottles* listed in Part C of the Annex may be placed on the market only if they are *made from at least 35% recycled content* and are recyclable."[126]

Its inclusion in policy is not firm as yet but if the requirement is included in legislation it will be the first quantitative, product specific, recycled content target in European legislation.

The PPWD is also relevant to consideration of recycled content as it sets out the recycling targets for plastic packaging. However, it seems as though these "push" measures driving waste packaging into recycling processes are considerably more ambitious than measures drawing material from recycling into secondary applications at this time.

The one place where there may be a real incentive introduced is in the "eco-modulation" provisions for EPR schemes, under which the distribution of full costs to producers would be "modulated" based on the environmental performance of the products placed on the market by producers. One of the obvious environmental

[126] Texts adopted - Wednesday, 24 October 2018 - *Reduction of the impact of certain plastic products on the environment* ***I - P8_TA-PROV(2018)0411, accessed 31 October 2018, http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+TA+P8-TA-2018-0411+0+DOC+XML+V0//EN&language=EN

performance characteristics that might be expected to lead to a reduced producer fee would be the inclusion of recycled content. As such, it may be that a strong economic incentive is introduced through these measures and that this serves to drive demand to pull secondary materials out of the waste stream.

However, it seems that the issue of recycled content will be very important going forward. This could be one area in which the Nordic group of countries could lead the way, and measures on recycled content could provide a powerful vehicle for increasing quality recycling and meeting the future targets. Such measures are elaborated on in Section 5.4.

5.4 Conclusions and Recommendations

The Nordic region includes some of the most developed and mature waste management systems in Europe, with various aspects of the waste and resource management industry in Denmark, Norway, Sweden and Finland rightly being seen as world-leading. The commitment of citizens, civil society and the major political parties across the region to the objectives of environmental protection and resource efficiency are amongst the highest globally. Although there is still much to do in the island nations to develop advanced waste management systems, the region as a whole is widely regarded as being at the forefront of tackling the key environmental, social and economic issues associated with inefficient resource use.

However, it is clear from the analysis of existing policies and historic performance against key indicators, set against the requirements of the revised EU waste directives, that very significant change will be required in every nation of the Nordic region. The clearest area of required change will be a significant shift away from incineration (and in Iceland, landfilling) towards recycling. This is likely to entail:

- A dramatic increase in coverage (both in terms of proportion on population covered and materials collected) of separate door-to-door collection of recyclables and biowaste. Mechanical sorting of these materials from mixed or heavily co-mingled streams is unlikely to be a substitute for this, as in order to meet the high recycling rates of the future, loss rates of target materials will need to be significantly lower than can be achieved through most forms of mixed material sorting;

- The introduction of more sorting capacity for mixed waste *after* separate collection has been maximised. This will help to capture more material for recycling (especially plastic) and to reduce the carbon intensity of municipal waste incineration fuels;
- The reform of policies that will help to drive this shift towards much higher rates of recycling, perhaps including:
  - increased taxes or bans on recyclable materials and biowaste entering incineration plants. Taxes and bans have proven effective in driving waste up the hierarchy in the Nordic region, but most of this has just shifted up as far as waste to energy incineration. If well-designed, the same instruments could be used to drive more waste up to the next tiers of the hierarchy;
  - reform of extended producer responsibility systems, regarding municipal waste especially in respect of packaging, leading to systems that:
    - efficiently transfer the full cost of recycling end of life packaging through the supply chain, such that consumers, through producers, bear these costs which are then paid to the actors who will physically undertake the necessary collection and recycling operations;
    - align the interests of all key parties (municipalities, producers and the recycling industries) to ensure that recycling operations are efficient and integrated and that duplication of effort in avoided, so that only the necessary cost is passed on to producers and consumers; and
    - incentivise redesign to include recycled content in products and for products to become more reusable or recyclable, leading to changes in the waste stream that make it increasingly economically viable to extract material for recovery at the higher tiers of the hierarchy.
  - minimum requirements for collection systems from different housing types, ensuring that the population coverage of collection systems capable of harvesting the necessary quantities of high-quality dry recycling and biowaste material is adequate;
  - the introduction of mandatory performance targets, accompanied as appropriate by sanctions, that can be applied to the actors who have the ability to change physical waste management systems at a local, operational level.

- The development of new recycling and biowaste treatment infrastructure, allowing the Nordic region to become a bigger player in its own right in the recycling of packaging and with a network of efficient biowaste treatment plants designed to process the much more "food waste rich" biowaste streams of the future;
- The instigation of "behaviour change interventions" that will be necessary for very high material capture rates to be possible. These might take the form of weight-based pay-as-you-throw systems or other communications initiatives backed by economic incentives (e.g. fines and surcharges) and enforcement. One way or another, the "social norming" of separating all recyclable materials for recycling, whether at home, work or on-the-go will have to be achieved.

Clearly, different Nordic nations are at different point in terms of the changes necessary to their waste management systems. However, the interventions outlined above are relevant to all nations, at least to a significant degree. Fundamentally, it will be necessary for the economics of municipal waste to change across the region, such that recycling either becomes reliably the cheapest option in the long term or becomes so mandatory that the necessary investment in infrastructure and change can be made.

The commonality of challenges facing the whole Nordic region means that there is considerable opportunity for collaboration between nations.

In some areas, collaboration will bring immediate benefits. For example, in market development for recycling applications for secondary materials, the aggregation of the economic strength and markets of multiple nations may make investment possible that would be impossible on the scale of a single country. One of the most interesting aspects of the current media and political focus on plastics is that the major global brands and their packaging material suppliers are now making commitments on both recycling rates and use of recycled content. The Nordic region would be likely to be seen as much more viable for investment in new packaging recycling infrastructure in the context of some cross-border collaboration and aggregation of tonnage.

In other areas, simply addressing common problems together will deliver both economies of scale and the benefit of building on best practices from across the region. New policy solutions will be required on EPR, as well as other economic instruments and interventions to drive separate collection and recycling. Although exactly the same solutions won't work in all nations, there will be many common denominators and much duplication of effort could be avoided by working collaboratively.

One key starting point is that in the very developed waste management systems of Denmark, Norway, Sweden and Finland, considerable optimisation has been achieved in *within the boundaries of existing performance.* However, the economics of different collection systems and sorting and recycling processes are likely to change significantly as recycling performance levels increase. This may mean that new options become viable or even optimal and considering these options jointly, where many of the housing type, geographic and climatic issues that can be a barrier to separate collection are common across nations.

Another key issue that is common to most nations (although to varying degrees) is the need to take a long-term view on managing the interplay between recycling and waste to energy incineration. Denmark and in particular Sweden appear likely to have significantly more capacity than will be required once the longer-term recycling targets have been met, even allowing for current levels of RDF imports. Norway and Finland both import and export RDF and have capacity that looks much closer to being in balance with long term national demand. However, the major Nordic countries are unique in Europe in terms of both the quality and efficiency of their incineration plants and the extent of use of heat in district heating networks. These factors, combined with the cold winters associated with their northern latitudes, means that it is difficult to talk simply about "over capacity", as continuing to import RDF from other European nations may well continue to make environmental and economic sense. The coordination of policy on taxation and import and export of waste for incineration would also be a key area where collaboration could add considerable value.

Overall then, it appears that although the challenges for each nation are relativity clear and will ultimately have to be addressed by the political leaderships, industry and citizens of each country, there is considerable opportunity for Nordic cooperation.

By reputation and perhaps public attitude, the Nordic nations should be at the cutting edge of driving towards a circular economy. Whilst some countries can legitimately argue that they are at the cutting edge in some areas, in every country there is a very significant need for change just in order to meet the minimum requirements of the EU – and no Nordic nation can claim any longer that they are a high performer in recycling by European standards. Regaining a legitimate claim to be leading the world towards sustainable resource use will require the Nordic nations to invest more heavily in reforming policy and waste management systems and in developing recycling-based markets and infrastructure. This will be challenging, but potentially highly economically and environmentally rewarding.

A key recommendation from this study of comparative performance, policy coverage and effectiveness is therefore that the Nordic nations, through the Nordic Council of Ministers, initiate a programme of practical cooperation on waste management reform in response to the EU's new waste directives. The consistency of issues faced across the nations is considerable and despite the many differences between them, it seems an ideal time for the region to accelerate cooperation and collaboration in this area. This collaboration could include necessary areas of development and change such as:

- Analysis of policy options on EPR, market development, fiscal reform and mandatory action;
- The development of a regional approach to market development and quality standards, particularly with regard to materials that are currently exported outside the region for recycling and in respect of waste to energy incineration capacity; and
- The central provision of technical support to nations and regions in considering their options for policy and operational reform.

Sammanfattning

Den norra delen av Europa har ett av de mest utvecklade avfallshanteringssystemen i Europa där Danmark, Norge, Sverige och Finland får anses vara världsledande i avfall- och resurshanteringsindustrin. Även om mycket återstår för att utveckla avancerade avfallshanteringssystem på Grönland, Island, Färöarna och Åland, får regionen i sin helhet anses vara i framkant med att ta itu med de miljömässiga, sociala och ekonomiska frågorna. Det finns problem mellan den befintliga infrastrukturen för avfall och den infrastruktur som krävs för att uppfylla och hantera de återvinningsmål som anges i de nationella avfallsstrategier (och EU:s avfallsmål). Nationerna har lite olika utmaningar för att kunna leverera ett effektivt avfallshanteringssystem för landsbygden och som är anpassade för extrema vinterförhållanden.

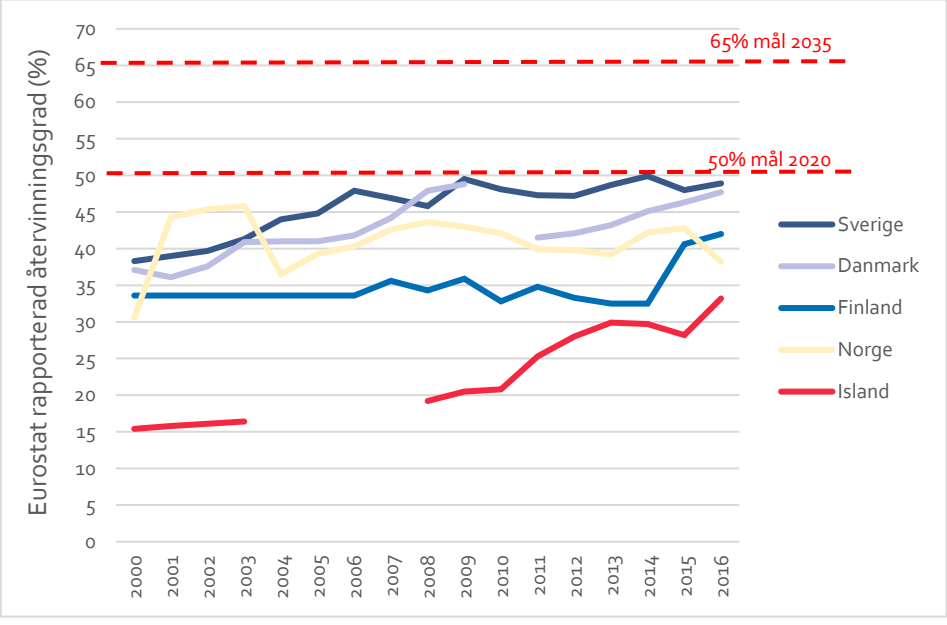
Just som vi befinner oss i en viktig tidpunkt för den nordiska avfallspolitiken genom EU:s gemensamma arbete med det nya paketet för cirkulär ekonomi så undersöker detta arbete de nordiska regelverken för avfall från 1970-talet och framåt gällande deras effekt på avfallshantering och återvinning.

Baserat på tidsserier med omfattande data från de fem nordiska länderna (Danmark, Norge, Sverige, Finland och Island) har ekonometrisk analys utförts, med syfte att identifiera de policyer som har haft en betydande inverkan på avfallsgenerering och återvinning. Den ekonometriska modellen omfattade makroekonomiska variabler som sannolikt skulle kunna påverka avfallets generering och återvinning, det vill säga: befolkning, bruttonationalprodukt och hushållens konsumtion. För att kompensera problemen med för lite datamängder för varje land utfördes även en paneldataanalys vilket är en mer robust analys än den landspecifika analysen.

Vid analys av data så framgår det att det finns policyer som har en signifikant negativ inverkan på avfallsgenerering, exempelvis visar närvaron av strategier ett samband med minskad avfallsmängd; förpackningsskatt och återhämtningsmål (ett mål för återvinning och energiåtervinning). För återvinningshastighet har följande policyer en signifikant positiv effekt på återvinningsgraden, dvs. att närvaron av strategier visar ett samband med ökad återvinningshastighet: deponeringsförbud mot både brännbart avfall och biologiskt nedbrytbart avfall, ett återbetalningssystem (DRS)

för metallbehållare och utökat producentansvar. Den ekonometriska analysen visar att det tydligt har varit ett antal effektiva policyers i de nordiska länderna som har ökat återvinningsgraden fram till idag. Det framgår emellertid också av analysen av befintlig politik och historisk prestanda mot nyckelindikatorer, i jämförelse med de reviderade EU: s avfallsdirektiv, att en väsentlig förändring kommer att krävas i varje nation i de nordiska länderna för att uppnå målen i EU:s avfallspolitik.

Figure 37: Rapporterad återvinningsgrad till Eurostat för kommunalt avfall hos de nordiska länderna



Som framgår av Figure 39 krävs det en 16–32 % ökning av återvinningsgraden till 2035 (jämfört med data från 2016) för att uppnå 65 % återvinningsgrad, även innan man ändrade definitionen av återvinning. Med tanke på att de ökningar av återvinningsgraderna som visas för de senaste 17 åren i Figure 39 ligger i storleksordningen mellan 10–20 %, är indikationen att betydande strategiska förändringar krävs av de nordiska länderna för att möta sådana mål.

Det tydligaste området för nödvändig förändring kommer att vara ett väsentligt skifte från förbränning (för Island deponering) mot återvinning. Det här kommer sannolikt att innebära:

- En dramatisk ökning av separat insamling av återvinningsbart och biologiskt avfall (både när det gäller andel av befolkningen som omfattas och material som samlas in).
- Införande av mer sorteringskapacitet för blandat avfall efter separat insamling har maximerats. Detta kommer att bidra till att fånga mer material för återvinning (särskilt plast) och för att minska koldioxidintensiteten hos bränslen för kommunalt avfall.
- Reformer av policies som kommer att bidra till att driva denna omställning mot mycket högre återvinningsnivåer, exempelvis:
  - Ökade skatter eller förbud på återvinningsbara material och bioavfall som går in i förbränningsanläggningar.
  - Utvidgade producentansvarssystem med avseende på kommunalt avfall, särskilt förpackningar. Detta kommer att vara ett krav för EU: s medlemsstater som en följd av ändringarna i ramdirektivet för avfall föra att möta de angivna minimikraven.
- Utveckling av ny infrastruktur för återvinning av biologiskt avfall.
- Styrmedel för att förändra beteenden. Detta kan innefatta användning av betalningssystem eller andra kommunikationsinitiativ som stöds av ekonomiska incitament (t.ex. böter och tillägg).

Det är uppenbart att olika nordiska länder står inför olika utmaningar när det gäller de förändringar som är nödvändiga för att förbättra sina avfallshanteringssystem. Dock är trenderna som identifierats ovan relevanta i stor utsträckning för alla länder som har ingått i studien. Grunden är att det är nödvändigt att bytesavfallets ekonomi förändras över hela regionen, så att återvinning antingen blir tillförlitligt det billigaste alternativet på lång sikt eller blir obligatoriskt så att den nödvändiga investeringen i infrastruktur och förändring kan göras.

De undersökta länderna står inför samma utmaningar och trots de många skillnader som finns mellan dem verkar det vara en idealisk tid för regionen att påbörja och påskynda ett samarbete i dessa frågor. Samarbetet kan innefatta nödvändiga utvecklings- och förändringsområden såsom:

- Analys av politiska alternativ för utvidgat producentansvar, marknadsutveckling, skattereform och obligatoriska åtgärder.
- Utveckling av ett regionalt tillvägagångssätt för marknadsutveckling och kvalitetsstandarder, särskilt när det gäller material som för närvarande exporteras utanför regionen för återvinning och för avfall till energiförbränningskapacitet.
- Det centrala tillhandahållandet av tekniskt stöd till nationer och regioner för att överväga deras alternativ för politisk och operativ reform.

På kort sikt finns möjligheten till synergi över hela den nordiska gruppen genom att identifiera exempel på bästa praxis för de länder som idag inte har någon bra förmåga att dra nytta av erfarenheterna från andra länder i regionen.

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Analysis of Nordic regulatory framework and its effect on waste prevention and recyclingin the region

At an important time in Nordic Waste Policy, as the 2018 Circular Economy Package makes significant updates to key European Union directives, this work looks back at the Nordic regulatory framework for waste from the 1970s and its effect upon waste prevention and recycling.

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