Annex 13 – Waste management

Links to Evidence

- Zero Waste Plan for Scotland
- SEPA Waste Data reporting
- SEPA Scotland's Waste Sites and Capacity data tool
- SEPA Scottish Household Waste data analysis tool
- SEPA Scotland's Environment Waste Discover Data Tool
- SEPA Business Waste Data
- SEPA Calculation Methodology for Waste Management Infrastructure Capacity Estimates 2018 data (published December 2020)
- UK Anaerobic Digestion Sites Map - REA (r-e-a.net)
- Fife Waste Analysis Study SIMD comparison case studies (2022)
- List and capacity of operational waste management sites in Fife 2021
- Breakdown of data on waste in and waste out of sites managed by Cireco in Fife

Summary of evidence

National Strategies, Legislation and Targets

A13.1 The Scottish Government aims to make Scotland a zero-waste society with a circular economy.

Scotland Zero Waste Plan (2010)

A13.2 The Zero Waste Plan for Scotland outlines the Scottish Governments vision for a Zero Waste Society. This describes a Scotland where all waste is seen as a resource; waste is minimised; valuable resources are not disposed of in landfills, and most waste is sorted, leaving only limited amounts to be treated.

A13.3 The Zero Waste Plan emphasises the importance of separating different materials in the waste stream to simplify the process of recovering their value.

A13.4 Moving towards zero waste means collecting, sorting, reusing, recycling, and energy recovery.

Waste (Scotland) Regulations 2012:

A13.5 Zero Waste Regulations were introduced by the Scottish Government in May 2012. They address both domestic and commercial/industrial waste. The Waste (Scotland) Regulations 2012 have three key action points:

A13.6 The Scottish Government will introduce progressive bans on the types of materials that may be disposed of in landfill to ensure that no resources with a value for reuse or recycling are sent to landfill by 2020 (this has been delayed to 1st January 2026);

A13.7 The Scottish Government will introduce regulations to drive separate collection and treatment of a range of resources in order to maximise their reuse and recycling value, and generate market supply;

A13.8 The Scottish Government will introduce regulatory measures to support the delivery of landfill bans, by ensuring energy from waste treatment is only used to recover value from resources that cannot offer greater environmental and economic benefits through reuse or recycling.

A13.9 This Regulation also sets out the requirement for businesses to collect dry mixed waste separately (glass, paper and cardboard, plastic and metal). Businesses that create 5kg or more of food waste per week must have separate collections for it. From a planning perspective, this could mean more bins on streets etc.

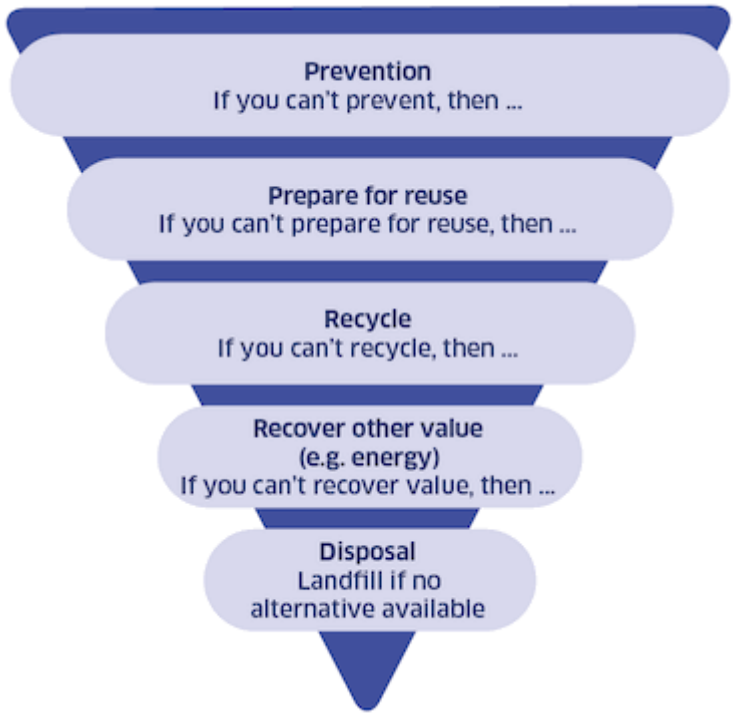
Circular economy strategy

A13.10 Making Things Last, A Circular Economy Strategy for Scotland was launched in 2016. It sets out priorities for moving towards a more circular economy – which means keeping products and materials in high value states for as long as possible.

A13.11 A circular economy is one that is designed to:

- **reduce** the demand for raw material in products;
- to encourage **reuse**, and **repair** by designing products and materials to last as long as possible; and
- **recycle** waste and energy to maximise the value of any waste that is generated in line with the waste hierarchy (see Figure 1 below).

Figure 1 - Waste hierarchy



Source: Scottish Government

A13.12 A circular economy would minimise demand on new resources and maximise the reuse, recycling and recovery of resources, rather than treating them as waste, it would benefit:

A13.13 The environment - by cutting waste and carbon emissions;

A13.14 The economy – by improving productivity and opening new markets;

A13.15 Communities – through more, lower cost options to access goods.

A13.16 The move to a circular economy will create opportunities for new businesses upcycling and repurposing waste and new specialist recycling centres such as the Yes Recycling's plastics facility in Glenrothes. Although this facility closed in 2023, new technologies are continually emerging in plastics and other material recycling.

Deposit Return Scheme

A13.17 The Deposit and Return Scheme (DRS) for Scotland Regulations 2020, were passed by the Scottish Parliament in May 2020. These regulations create a legal framework for a deposit return scheme (DRS) for single-use drinks containers to be introduced. People will pay a 20p deposit when they buy a drink that comes in a single-use container made of PET plastic, steel and aluminium, or glass. They will get their money back when they return the

empty container to one of tens of thousands of return points. Retailers will have a legal requirement to accept returns of empty drink containers for collection for recycling.

A13.18 DRS will establish a new network of recycling points and reverse vending machines (to get deposits back), as well as pick-ups for online deliveries; and will require both household and commercial behaviour change in order to be successful.

A13.19 DRS was due to go live in July 2022 but implementation has been delayed to October 2025 at the earliest, which is when other nations in the UK also plan to launch their schemes.

A13.20 DRS will provide opportunities for businesses and create jobs within the circular economy. There is presently a lack of clarity over how this scheme is most likely to operate, some key questions are:

A13.21 How will infrastructure support the DRS scheme: storage of bottles, transport of bottles.

A13.22 Impact analysis of space implications for small businesses,

A13.23 Impact on Council collections as higher quality recyclates are diverted from recycling bins to DRS, leaving the council with lower quality materials.

Extended Producer Responsibility (EPR)

A13.24 Although EPR will not have a direct impact on Planning, it is one of the key waste policies that will come into effect from late 2025 (date still to be confirmed). EPR is a scheme where producers pay for the cost of the packaging waste they produce from manufacture to disposal. The aim being a move towards using more sustainable materials. Local Authorities will have report on the packaging they handle and will be paid through the scheme. EPR is a UK wide scheme and Scotland. Three other EPRs are being looked at covering: an end-of-life vehicle scheme; batteries; and textiles.

Persistent Organic Pollutants (POPs)

A13.25 POPs are currently a key concern within the waste management sector. POPs are materials used in flame retardants for sofas and other soft furnishings; when these become in a poor condition there is a risk that the POPs escape, bioaccumulate and pollute the environment. Currently in Scotland and the rest of the UK, Waste Upholstered Domestic Seating (WUDS- sofas and other soft furnishings) which cannot be reused must be sent for incineration. From the 1st February 2024, SEPA will take enforcement action if these items are sent to landfill. DEFRA are currently examining POPs

in construction and demolition waste although the outcomes of this will not be known for a couple of years. POPs are covered by the Stockholm Convention and implemented in the UK by the POPs Regulations 2007 which SEPA enforce in Scotland.

A13.26 The main impacts of POPs in land use terms is the extra storage capacity needed at waste facilities to segregate them.

Approved National Planning Framework 4 (2023)

A13.27 Conserving and recycling assets is one of the six overarching spatial policies in the approved NPF4. The expectation is that we will make productive use of existing buildings, places, infrastructure and services, locking in carbon, minimising waste and building a circular economy.

A13.28 Circular Economy Materials Management Facilities are identified as one of the national developments in NPF4 - supporting the development of facilities required to achieve a circular economy anywhere in Scotland. As a result any proposals for facilities for managing secondary materials; and recycling facilities will be classed as national developments.

A13.29 In line with Scotland's circular economy strategy the approved NPF4 Policy 12: Zero Waste sets out that:

A13.30 Local development plans should identify appropriate locations for new waste management infrastructure to support the circular economy and meet identified needs in a way that moves waste as high up the waste hierarchy as possible.

A13.31 Development proposals will seek to reduce, reuse, or recycle materials in line with the waste hierarchy.

A13.32 Proposals will be supported where they take circular economy principles into account including reusing existing buildings and infrastructure, minimising demolition and salvaging materials for reuse, and using materials with the lowest forms of embodied emissions such as recycled and natural materials.

A13.33 Information on approaches to calculating embodied carbon in the built environment and development works are discussed later.

A13.34 Policy 12 also sets out that development proposals for energy-from-waste facilities will not be supported except under limited circumstances.

Scottish Targets for Waste:

A13.35 Zero waste targets set by the Scottish Government remain ambitious. Current targets reflect those set in 2018 with reduction in landfill, food waste and overall waste targets still set at the goals outlined in previous years:

Table 1: Breakdown of current Scottish Targets for waste. Source: Scottish Government

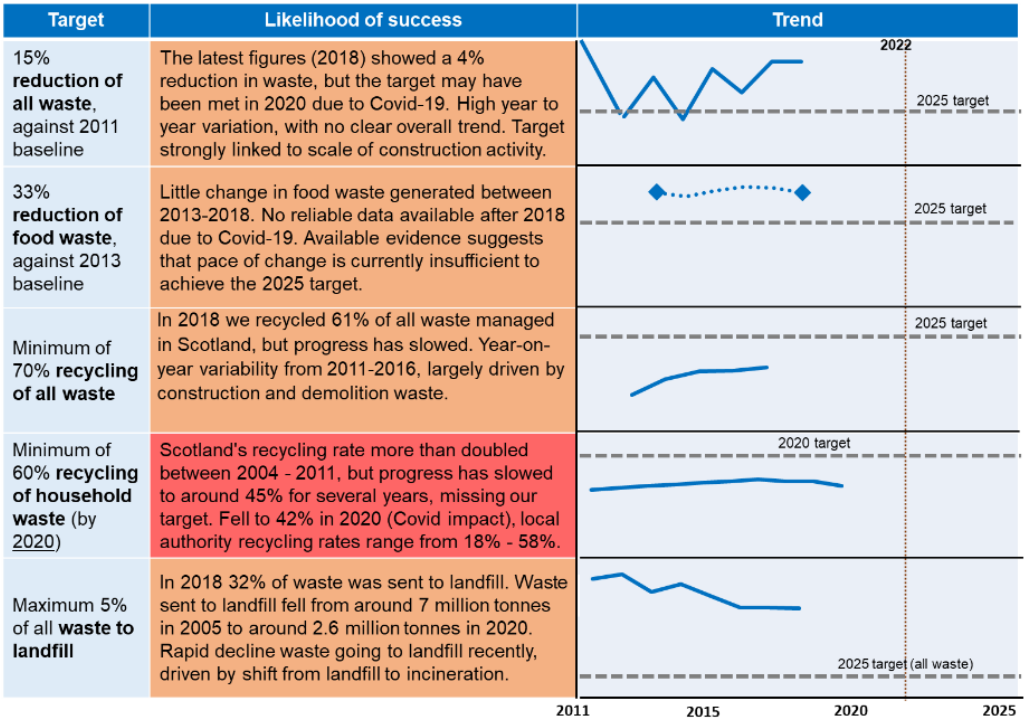
Waste Target	Target year	Derivation
Preparing for re-use and recycle 70% (by weight) of construction and demolition waste	2020 - (Target met)	Article 11(2)(b) of the revised EU Waste Framework Directive
60% recycling/composting and preparing for re-use of waste from households.	2020 – (Target not met)	Scottish Government target (Zero Waste Scotland)
15% reduction of all waste arising against a 2011 baseline	2025	Scottish Government target
100% Ban on biodegradable municipal waste sent to landfill	2025	Waste (Scotland) Regulations 2012 (2019 revision)
Less than 5% of waste from all sources to go to landfill	2025	Scottish Government target (Zero Waste Scotland)
Recycling/composting and preparing for reuse 70% of waste from all sources	2025	Scottish Government target (Zero Waste Scotland)
Reduce food waste by a third against a 2013 baseline	2025	Scottish Government target (Circular Economy Strategy)

A13.36 The government targets include ambitious reductions across all types of waste and the timeframe to achieve them is short, with most targets hoping to be achieved by 2025, this is before LDP2 will be adopted so the waste targets will need to be revisited through the LDP process.

Scottish Government Plans for meeting 2025 waste targets and beyond:

A13.37 In May 2022 Scottish Government published Delivering Scotland's circular economy - route map to 2025 and beyond for consultation. This document admits that despite Scotland having a good track record on the circular economy it is not currently on track to meet the ambitious waste and recycling targets see Figure 2 below.

Figure 2 -Figure 2. Progress towards Scotland's 2025 waste and recycling targets since 2011



Key: Red indicates a missed target, orange indicates a target at risk. Source: Delivering Scotland's Circular Economy – Route Map to 2025 and beyond (May 2022)

A13.38 The Circular Economy Route Map is a strategic plan to achieve Scotland's zero waste and circular economy ambitions, and to contribute to wider net zero ambitions, including the major policy interventions and milestones required to achieve this ambition.

A13.39 The proposed priorities in the Route Map are to:

A13.40 Promote responsible consumption and production (including reducing consumption of single-use items, promoting product design and stewardship and mainstreaming reuse)

A13.41 Reduce food waste from households and businesses

A13.42 Improve recycling from households and businesses

A13.43 Embed circular construction practices (this could include incentivising the refurbishment of buildings)

A13.44 Minimise the impact of disposal of waste that cannot be reused or recycled

A13.45 Strengthen our data and evidence, sustainable procurement practices, and skills and training

A13.46 The 3rd, 4th, and 5th priorities are of most relevance to planning processes. The approved NPF4 policy 12 provides the necessary policy structure to support the 3rd and 4th priorities.

A13.47 The route map is partnered with the Circular Economy Bill, which was approved in June 2023. The route map was consulted on in 2022 and it is anticipated that the route map will be published in 2024.

A13.48 To minimise the impact of the disposal of waste Scottish Government propose to develop a Residual Waste Plan by 2024; it will aim to ensure that the management of residual waste meets net zero targets. There has also been a review of the role of incineration (Stop, Sort, Burn, Bury? – Report May 2022) in Scotland's waste hierarchy which recommends that no further planning permission is granted to incineration infrastructure unless balanced by a close of capacity. The approved NPF4 policy 12 supports this position by not supporting energy from waste proposals except under limited circumstances.

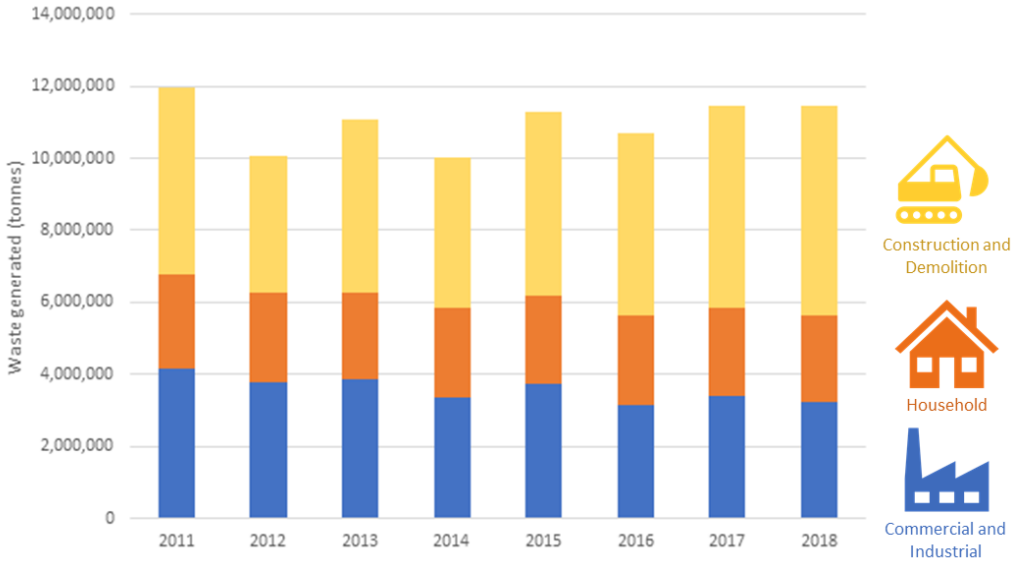
Waste generated in Scotland

A13.49 Recorded waste generated in Scotland is divided into commercial and industrial waste; construction and demolition waste; and household waste. Commercial and industrial waste includes waste from the following sources:

- Agriculture, forestry and Fishing
- Commerce
- Manufacture of chemicals, plastics and pharmaceuticals
- Manufacture of food and beverage products
- Manufacture of wood products
- Mining and quarrying
- Other manufacturing
- Power industry
- Waste management
- Water Industry

A13.50 Figure 3 shows a breakdown of all waste generated in Scotland between 2011 and 2018.

Figure 3 - Breakdown of waste generated in Scotland.



Source:- Waste (from all sources) (sepa.org.uk)

A13.51 If construction and demolition waste is excluded from the figures it is apparent that waste generation has generally been decreasing in Scotland since 2011. And trends indicate that it is construction and demolition waste that will largely determine whether Scotland's 15% waste reduction target is met (Scottish Government Technical Annex: Delivering Scotland's Circular Economy – Route Map to 2025 and beyond (May 2022) page 7). The approved NPF4 policy on waste prioritises the reduction and reuse of materials in construction.

Construction and demolition waste

A13.52 Figure 3 shows that construction and demolition processes generate around 50% of the waste generated in Scotland. However, the volume of that waste generated varies year on year depending on the buoyancy of the construction industry and large regional projects. Waste from construction and demolition is only recorded on a national level, so we have no figures on this for Fife.

A13.53 Most waste from construction and demolition is made up of soils or mineral waste. In fact, waste soils provided 37.5% of all waste generated in Scotland in 2018 - twice the amount of waste that was generated by households. Since 2011 well over 90% of all construction and demolition waste has been recycled and in 2018 the figure was up to 97% (SEPA Waste from all sources – summary data 2018 page 4). This means that the target of the re-use and recycling of 70% (by weight) of construction and demolition waste by 2020, which was set in Article 11(2)(b) of the revised EU Waste Framework Directive, has been met nationally.

A13.54 Construction and demolition waste contains a large variety of materials including wood, brick, glass and plastic; and the reuse potential and recycling process is different for each type of material. Some materials such as plastic can be recycled alongside household processes, some such as bricks can be reused, whilst others are broken down and landfilled. One area in this sector where waste has been reduced is wood waste which is now sent to biomass plants or reused rather than ending up in landfill. Zero Waste Scotland have produced a guide on the reuse and recycling of construction materials onsite – Maximising re-use of materials on site.

A13.55 Construction and demolition waste will not currently be affected when the statutory landfill ban comes into force in 2026 as the ban only covers biodegradable municipal waste. That means that materials that can't be recycled, reused or degraded could still be landfilled; however, this may well change in the future as the Scottish Government is currently looking to ban biodegradable non-municipal wastes from landfill (also see above re POPs).

Waste in Fife

A13.56 Fife's Zero Waste Plan (Resource Strategy and Action Plan for Fife' 2018-28) (to be reviewed and updated 2024) focusses on the reduction of waste. It highlights the need to ensure that Fife Council's waste management infrastructure is fit to meet future legislative and policy requirements to maximise recycling potential. It also highlights issues around managing non-recyclable waste, including identifying actions to develop policies to reduce the impact of the Council's legacy waste sites and develop a strategy for residual waste treatment post 2020. The strategy was to identify and agree contracts to replace waste to landfill with waste to Energy from Waste, this has now been completed although the timescale has moved from 2020 to 2025 as Scottish Government's timescale to ban biodegradable waste to landfill changed to 2025.

Fife's Waste targets

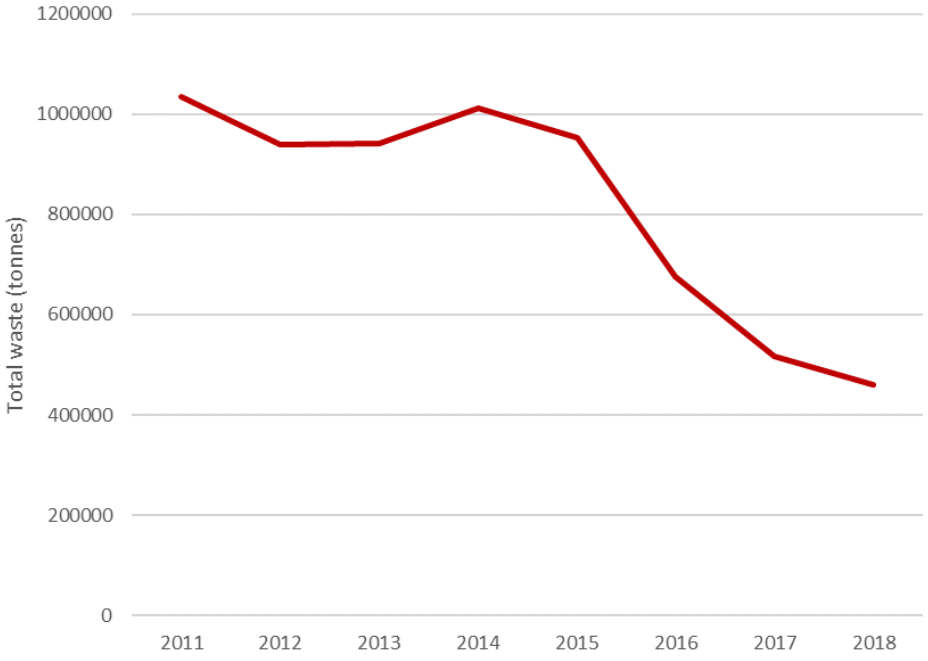
A13.57 The waste targets for Fife are set out in the Zero Waste Fife Resource Strategy and Action Plan (2018-2028) and are the same as the Scottish Government targets for waste set out in Table 1.

Waste generated in Fife (household and business waste)

A13.58 Scottish Government and Fife waste targets include a 15% reduction of all waste arising against a 2011 baseline by 2025, (SEPA defines waste arisings as: The amount of waste generated in a given locality over a given period of time). It will not be possible to measure this specifically for Fife because information on certain types of waste (such as construction and demolition) is only available at a national level. We do however have information on household and business waste generated in Fife as SEPA collects this information and publishes it for Local Authorities. The most up to date information SEPA has on household waste is from 2022 and for business waste is from 2021.

Household and business waste in Fife

Figure 4 - Household and business waste generated in Fife



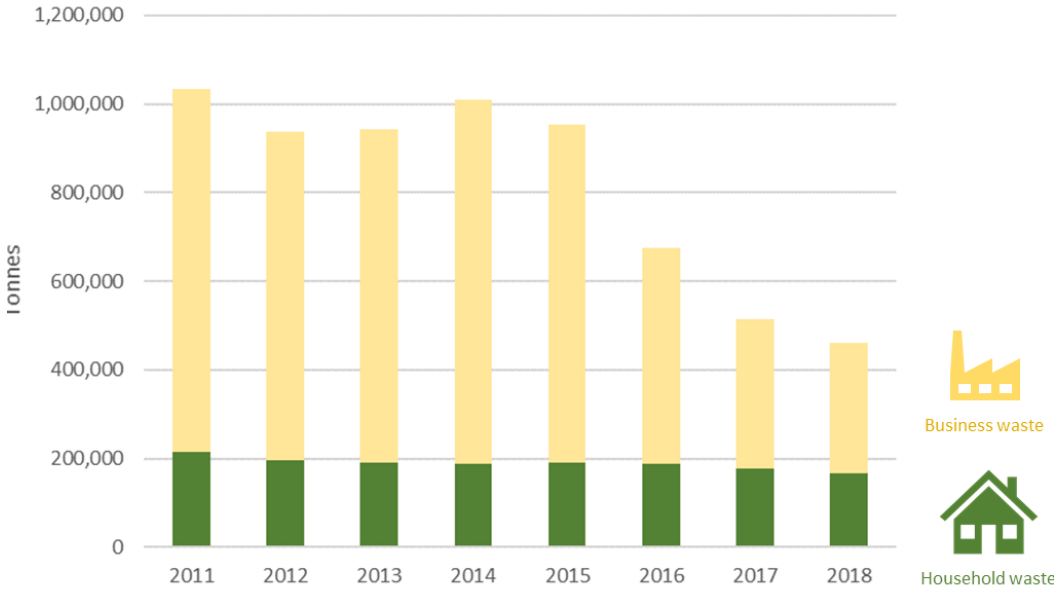
Source:- Household Waste (sepa.org.uk) & Business waste data | Scottish Environment Protection Agency (SEPA)

A13.59 Figure 4 indicates that the total waste generated from households and businesses in Fife fell significantly from 2011 to 2018 with a 55.5% reduction in total. This is a far higher decrease than the total waste levels in Scotland which have reduced by 14.9% over the same period and shows that Fife has easily exceeded the 15% target for the reduction in waste arisings by 2025.

A13.60 Figure 5 provides a breakdown of household and business waste in Fife between 2011 and 2018. The diagram shows that the volume of

household waste fell slightly over that period while business waste shows a huge drop in the volume generated with the biggest fall between 2015 and 2016. This can be attributed to the closure of Longannet Power Station in early 2016 which reduced the combustion waste generated in Fife from just over four hundred tonnes in 2015 to five and a half tonnes in 2018.

Figure 5 - Breakdown of waste generated in Fife



Source:- Household Waste (sepa.org.uk) & Business waste data | Scottish Environment Protection Agency (SEPA)

A13.61 Fife has the second highest volume of business waste recorded in Scotland, more than both Edinburgh and Glasgow cities.

A13.62 Figure 6 provides a breakdown of the largest generators of Fife's business waste and shows that there is a high volume of agriculture waste recorded in Fife a full breakdown of Fife's business waste by type is available in SEPA's Business Waste Data 2021 (table 2). This waste is used as a 'feed' for Fife's Combined Heat and Power (CHP) and Biomethane-to-Grid (BtG) anaerobic digestors. Fife records by far the largest amount of animal faeces, urine and manure waste in Scotland (over 71,00 tonnes in 2018). Most Local Authority areas recorded less than 1,000 tonnes with North Ayrshire recording the second highest amount at 21,000 tonnes. SEPA has confirmed that most of this waste comes from out with Fife. In addition agricultural waste is recorded in Fife as it has a monetary value; in other areas where it does not have a significant monetary value less agricultural waste goes through the waste transfer stations and so is not recorded in the statistics – this helps to explain the high volume of business waste in Fife.

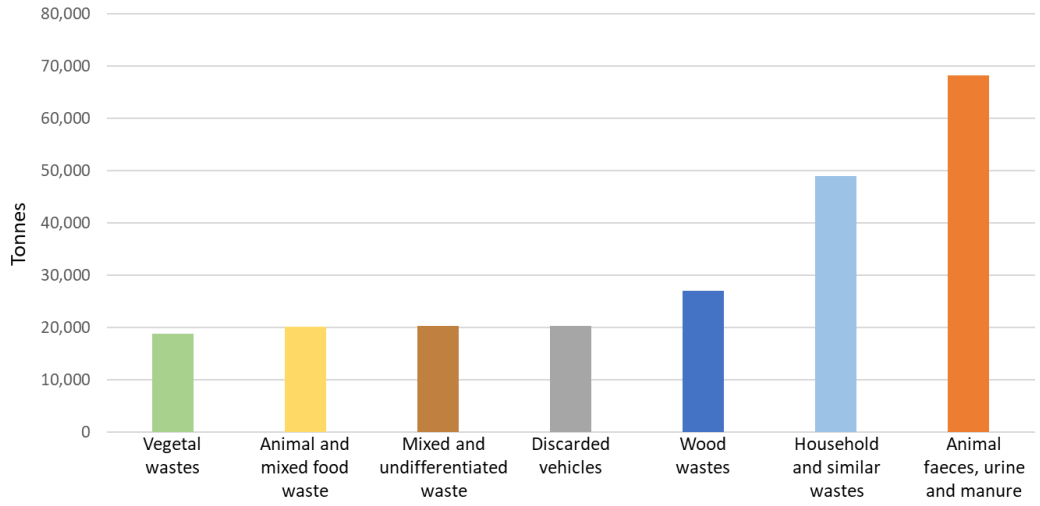


Figure 6 – Fife business waste highest generators by source (2021)

Source:- SEPA business waste statistics 2021

A13.63 Figure 6 shows that the majority of business waste generated in Fife is 'household and similar wastes' which refers to the blue bin for landfill waste. More work could be done in this area to encourage businesses to move away from the blue landfill bin and follow the waste hierarchy by reducing and recycling more.

Waste management, landfill and recycling

A13.64 Information is not available specifically for Fife on how much business waste is landfilled although we do have that information for household waste (see figure 8). This means that we cannot monitor how much of all the waste generated in Fife goes to landfill, however figures for Scotland are available up to 2018 (see figure 7).

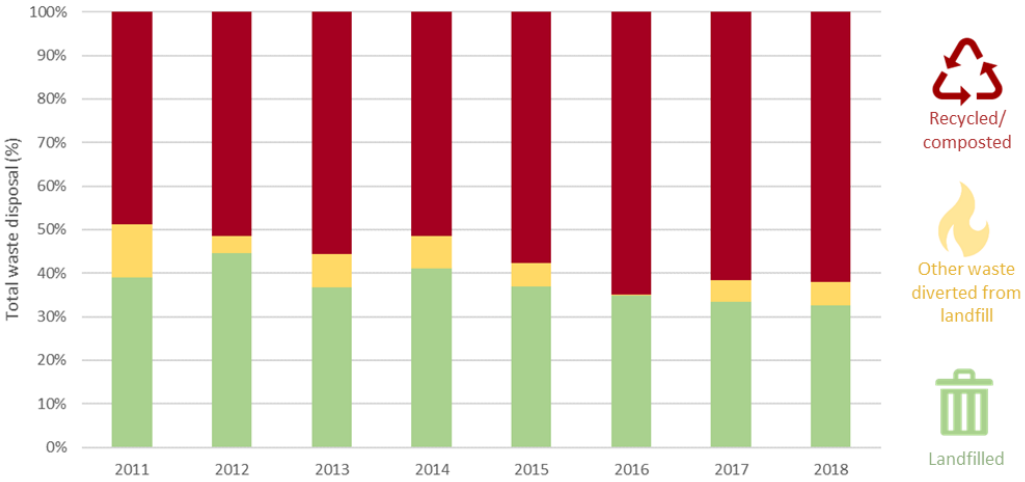


Figure 7: Management of waste generated in Scotland

Source: Scotland Waste generation data: https://informatics.sepa.org.uk/WasteAllSources/

A13.65 Figure 7 shows that the percentage of waste sent to landfill in Scotland has gradually been reducing over the last few years and that is reflected in the volume of waste being landfilled which reduced by around a million tonnes per annum over the same period.

A13.66 Over the same period overall recycling rates have been gradually increasing in Scotland with much of the recycled waste coming from construction and demolition processes as previously discussed. However, the percentage of household waste which is recycled is much lower.

Fife household waste management

A13.67 Fife's recycling rate has plateaued in recent years, but it has started to recover since the pandemic. The table below shows the tonnage recycled and the recycling rates in Fife over the last 5 years:

2018		2019		2020		2021		2022	
85471t	51.1%	77856t	44.5%	68219t	43.7%	72788t	43.6%	78572t	45.7%

Table 2: Fife Household waste recycling rates. Source: SEPA: household waste data

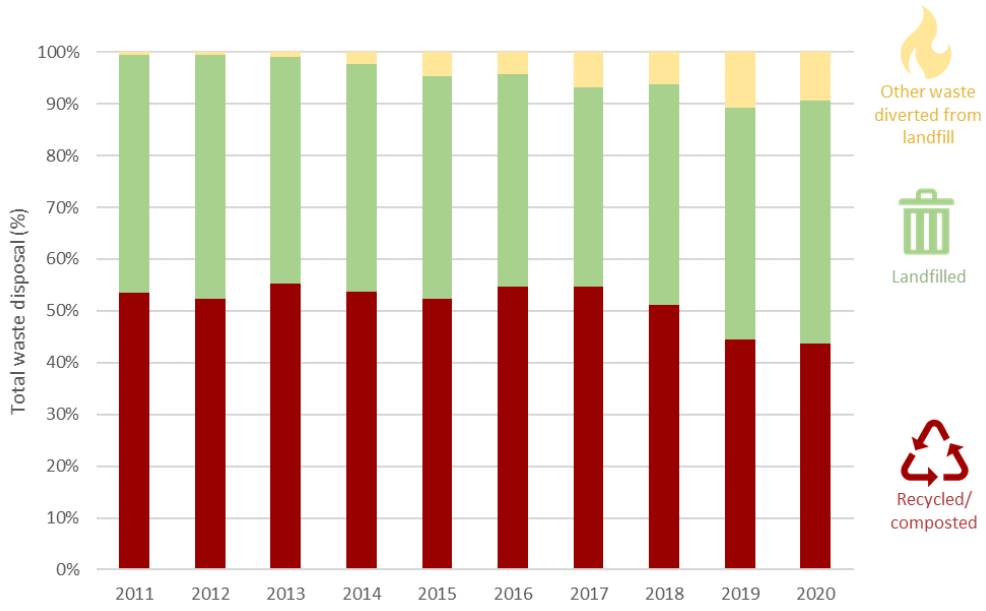


Figure 8: Breakdown of Fife's household waste disposal
Source:- Household Waste (sepa.org.uk)

A13.68 The Scottish Government target for household recycling to reach 60% of the total waste disposal by 2020, has not been achieved. There is potential that when the deposit return scheme (DRS) comes into force a significant

amount of plastic/cans waste could be diverted from landfill and recycled.. However, as the DRS is yet to be launched there isn't a clear timeframe to hit any future goals yet.

A13.69 From the Fife household statistics and the Scottish statistics for all waste in figures 7 and 8 it is clear that we are some way off meeting the 2025 targets of less than 5% of all waste going into landfill and recycling/composting and preparing for reuse 70% of waste from all sources.

Biodegradable waste

A13.70 In 2026 there will be a 100% ban on biodegradable municipal waste going into landfill and must either be recycled, composted, incinerated, reused or recovered by another means rather than going into landfill, (Municipal waste relates to waste collected by the local authority). This ban was set out in the Waste (Scotland) Regulations 2012 (2019 revision). As it is impossible to ensure that the waste collected by local authorities is properly sorted this effectively becomes a ban on all municipal waste going into landfill sites. Figure 9 shows that the amount of biodegradable waste going into landfill in Scotland has been decreasing and previous targets for the reduction of biodegradable waste being landfilled have been met.

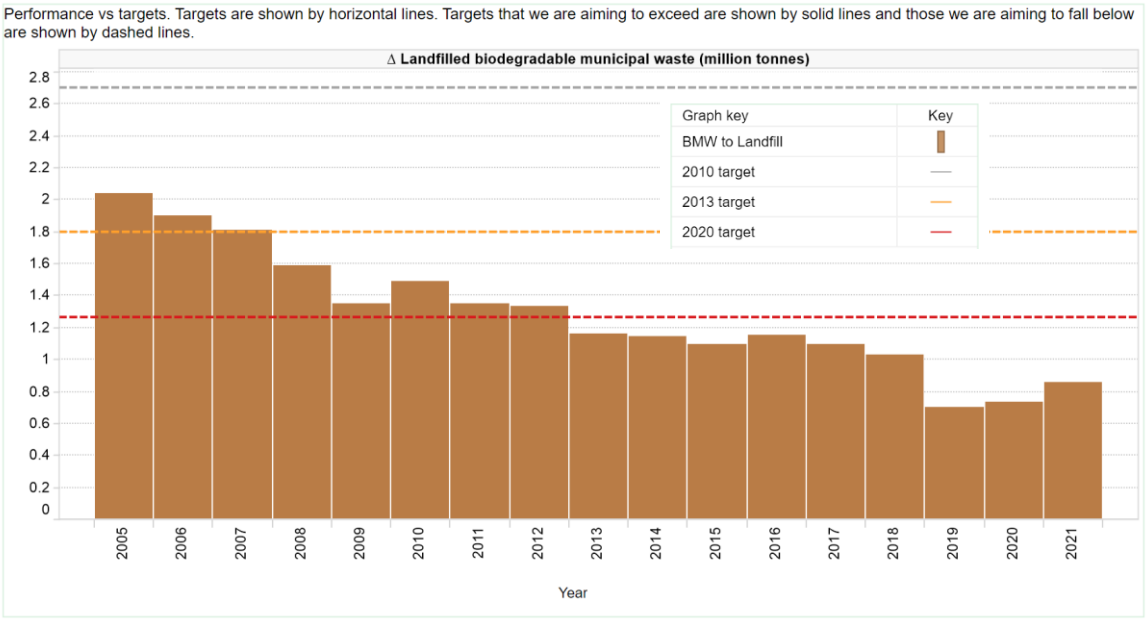


Figure 9: Biodegradable municipal waste going to landfill in Scotland
Source: Scotland Waste generation data: https://informatics.sepa.org.uk/WasteAllSources/

A13.71 Scottish Government is also intending to extend the ban on landfilling biodegradable waste to non-municipal wastes subject to additional

consultation and assurances1, which will require additional and alternative waste infrastructure to be provided either within Fife or nationally.

How much Biodegradable waste is currently sent to landfill in Fife?

A13.72 Fife Council commissioned a study of waste collected over a 14 day period in five settlements in Fife from a range of categories in the Scottish Index of Multiple Deprivation (SIMD): Dunfermline (SIMD 8), Cardenden (SIMD 2), Kelty (SIMD 2), Star (SIMD 8.5) and Dalgety Bay (SIMD 10). It includes data on the volume and type of residual waste that was collected in the landfill bins.

A13.73 In the study, all five of the test areas recorded biodegradable waste (food and drink (in and out of packaging), as well as animal waste (e.g. litter, dead animals and pet excrement)) in the landfill bins indicating that these bins are not being used correctly.

A13.74 The areas with the highest volume of biodegradable waste going to landfill were Kelty and Cardenden, with a high volume of 'food and drinks (avoidable) loose' being disposed of in Kelty. Kelty and Star had the most animal waste going into landfill, much more than the other three towns. Dalgety Bay has the highest SIMD of 10 and was among the lowest for each waste typology (although disposable nappies were high).

A13.75 Based on these findings, it would suggest there needs to be better communication and community engagement with the more deprived areas to understand their waste needs and knowledge. In the more rural locations such as Star, there may be additional waste facilities needed to meet the requirements of the town such as a small transfer station or larger recycling facility to prevent any biodegradable waste ending up in landfill. A summary of the study provides the full breakdown containing the accurate volume of waste.

A13.76 The landfill ban will create opportunities for alternative uses for the Fife's existing landfill sites, including renewable energy generation and infrastructure to support the circular economy.

Food Waste

A13.77 Calculating the amount of food waste that is generated in Scotland is problematic and there is no reliable national data since 2018 as noted in

[1] Scottish Government Update to the Climate Change Plan-2018-203 Securing Green Recovery on a Path to Net Zero

Delivering Scotland's circular economy A Route Map to 2025 and beyond. There is no data available on food waste at a Fife level.

Scotland's imported and exported waste

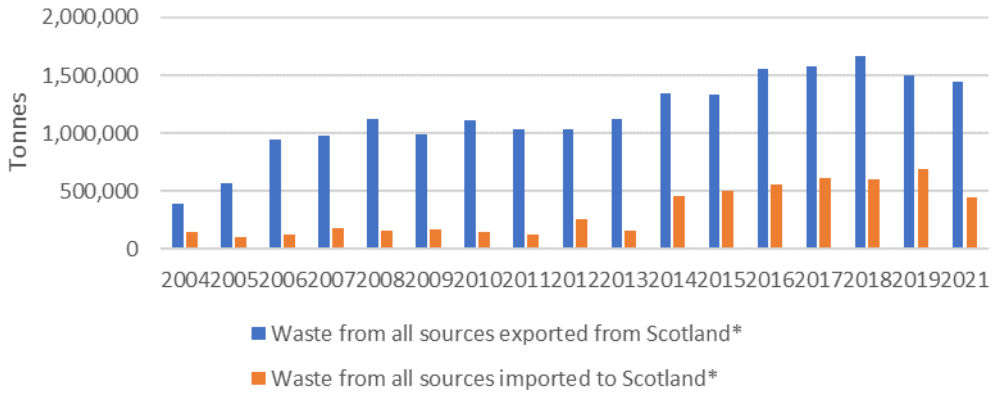


Figure 10: Waste imported and exported from Scotland. Note: this data will be incomplete as any waste imported or exported which does not pass through a waste management site is not included.
Source: SEPA 2021 limited waste data tables

A13.78 Figure 10 shows that Scotland is a net exporter of waste and the volume of waste being exported has increased substantially since 2004. Figure 11 provides a breakdown of the type of waste that was exported from Scotland in 2019.

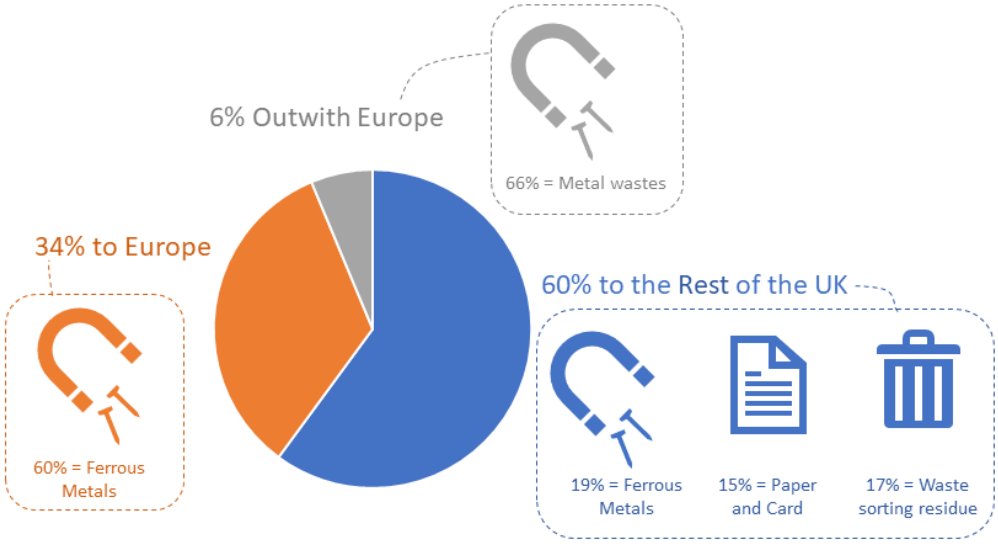


Figure 11: Breakdown of waste exported from Scotland in 2019
Source: SEPA 2020 limited waste data tables

A13.79 Looking at the volume of waste exported, Scotland sells a high volume of waste to the rest of the UK, Europe and further afield. This will vary depending on the price to sell the waste as a commodity verses the total cost

of disposal, and which offers better value. For example, 60% of the waste exported to Europe is ferrous metals that will then be reused or repurposed, and the price to buy the metal is potentially higher than the total cost of Scotland disposing of it, therefore exporting it is preferred. Zero Waste Scotland reports that in 2018 a total of 820,000 tonnes of scrap steel was exported to locations such as Turkey, Spain and Pakistan for melting and reusing. The Zero Waste Scotland Steel report promotes the establishment of an Electric Arc Furnace in Scotland to recycle steel and ferrous metals: utilising Scotland's low carbon electricity and making carbon savings from this aspect of waste recycling. However, the Steel report has been challenged by the British Metals Recycling Association who have asked for it to be withdrawn and there is no mention of the proposal in the route map so it is unclear what support there is for this proposal.

A13.80 Figure 10 also shows that the amount of waste being imported into Scotland increased since 2004 (although it fell slightly in 2021). The largest volume of waste that was imported into Scotland was wood waste (over 350,000 tonnes in 2019 although this fell to just under 250,000 tonnes in 2021) most of which is used for biomass processes. As will be discussed later, biomass plants such as the RWE Biomass plant in Markinch run primarily on waste wood with a small portion of new raw materials being used.

Waste Management infrastructure

A13.81 There are many forms of waste management infrastructure which operate at quite different levels in the waste management hierarchy, from landfill sites to recycling points. Figure 12 shows the locations and types of waste management sites in Fife.

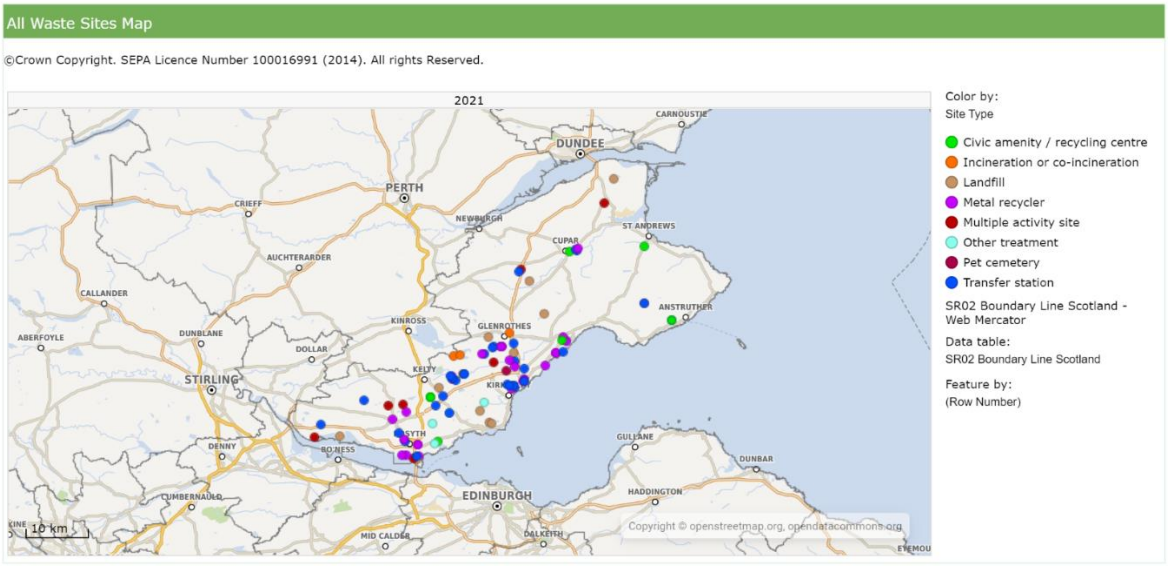


Figure 12: Waste management sites in Fife.
Source: https://www.sepa.org.uk/data-visualisation/waste-sites-and-capacity-tool/

A13.82 Detail on the capacity of these waste sites and whether or not they are currently operational is available in the Waste Sites Capacity Fife 2021 data from SEPA.

A13.83 Changes in legislation and new ways of collecting and processing waste will need a changed approach to how waste is collected, managed and processed. The main anticipated requirements for new waste management infrastructure are likely to be related to the processing of waste as part of a move to a circular economy and the landfill ban. The processing of waste may involve sorting of materials to be sent elsewhere, or various levels of additional on-site processing needed to make materials re-usable. The details of what is needed are something of an unknown at this time. Existing waste management sites in Fife (Lower Melville Wood and Lochhead) are the obvious locations for processing to take place, but consideration could be given to other locations to support this.

A13.84 SEPA has developed a Calculation methodology for waste management infrastructure capacity estimates (2020) to support Scottish Governments Circular Economy Strategy.

A13.85 The methodology assesses the quantity of waste currently landfilled and determines how waste will be managed in 2025 given the targets for recycling 70% and landfilling no more than 5% of the waste from all sources, and the ban on sending biodegradable waste to landfill by 2025.

A13.86 The additional capacity required is presented regionally and the allocation is based on the proportion of waste generated in the specified area in relation to total waste generated in Scotland and three types of additional capacity are presented:

- Tonnes of additional capacity
- Additional capacity needed to manage source segregated waste
- Additional capacity needed to manage unsorted waste.

A13.87 Fife sits within the SESplan and TAYplan areas, the following additional capacity information is available for these areas in the Scottish Planning Policy (SPP) Waste Capacity Infrastructure Tables (2018 data) finalised Dec 2020 (see tables 1 and 2).

A13.88 This data is not available at local authority level so we do not have required capacity figures for Fife from the document. We have applied a pro-rata figure to give an indication of the capacity required in Fife and added that information to the table. The percentages applied are based on the

assumption that approximately 20% of Fife's population lives in the TAYplan area. Using the 2021 mid year population estimates we can calculate that around 23% of people in the SESplan area live in Fife and around 15% of the TAYplan population.

	SESplan	TAYplan	Fife SESplan area 23% applied	Fife TAYplan area 15% applied
Total additional diversion capacity needed	440,000	90,000	101,200	13,500
Additional capacity needed to manage source segregated recyclables*	190,000	40,000	43,700	6,000
Additional capacity needed to manage unsorted waste†	250,000	50,000	57,500	7,500

Reported to nearest 5,000 tonnes.
* clean MRF, AD, composting, and other e.g. baling, shredding and cleaning source segregated recyclables
† dirty MRF, MBT, MHT, EfW

Table 3: Additional operational waste management infrastructure capacity required to meet the Making Things Last targets (tonnes)

Source: Table 1 from SEPA: Calculation Methodology for Waste Management Infrastructure Capacity Estimates 2018

	SESplan	TAYplan
10 year capacity of existing landfill infrastructure	6,350,000	250,000
10 year landfill required capacity	3,270,000	690,000

Reported to nearest 10,000 tonnes

Table 4: Ten year rolling landfill capacity required (tonnes) - Calculation Methodology for Waste Management Infrastructure Capacity Estimates

Source: Table 2 from SEPA: Calculation Methodology for Waste Management Infrastructure Capacity Estimates 2018

A13.89 The additional recycling capacity mentioned in table 1 refers to the capacity of new waste disposal infrastructure needed to meet the 2025 Scottish Government targets. The figures in table 1 are calculated based on the assumption that by 2025, the target of a 15% waste reduction from the 2011 baseline has been met. The volumes given in table 2 have been calculated using the average total volume of waste generated in Scotland (soil excluded) in 2018 times by 10 to understand the total capacity needed over a 10-year period which covers post-2025. SEPA explains this additional

capacity required in Scotland 'maximises resource value and minimises the impact of disposal on the environment' through diverting waste from landfill.

A13.90 The figures in table 2 would indicate that there is considerably more landfill capacity than required in the SESplan area but not enough in the TAYplan area. There is more detail below on the capacity of Fife's two landfill sites which indicate that there is more than enough landfill capacity in the Fife area.

Incineration

A13.91 Choosing incineration over landfill prevents large amounts of methane from landfill being released however the burning process emits greater volumes of other gases such as hydrochloride acid and sulphur dioxide. These gases are scrubbed from the flue gas using bag filters; the waste material generated is called air pollution control (APC) residual or "fly ash". There is still a degree of waste with incineration in terms of bottom ash and APC residual (UN Waste-to-Energy Incineration | International Environmental Technology Centre (unep.org)). This waste needs to be either recycled or landfilled, however recycling abilities are limited for this form of waste, that means that outputs from incineration will need to be included in the 5% landfill exception. Greater controls on waste collection will be required to prevent biodegradable/recyclable waste from ending up in incineration.

A13.92 The Lower Melville Wood site in Fife has a pad where Incinerator Bottom Ash (IBA) is stored. The IBA is processed around once every 6 months to remove the scrap metal and crush it into different grades of aggregate which is either used in the landfill for capping or sold. Prior to processing the IBA will be tested to ensure it is within acceptable levels of certain heavy metals. If it exceeds these, it can't be processed and must be disposed of.

A13.93 As previously outlined NPF4 does not support additional incineration infrastructure other than in exceptional circumstances so alternatives to incineration need to be prioritised.

Fife's existing waste management infrastructure:

Landfill sites and transfer station

A13.94 Fife currently has two operational landfill sites managed by Cireco on behalf of Fife Council: Lochhead in Dunfermline and Lower Melville Wood near Ladybank. The total capacity for landfill in these sites is 665,000 tonnes per annum. In 2022 208,100 tonnes of waste was disposed of across the two landfill sites (Source: SEPA Scottish Waste sites and capacity tool). There

remains considerable capacity at the two landfill sites although both are estimated to cease landfill activities on the 31st Dec 2024.

Lower Melville Wood, near Ladybank

A13.95 It is anticipated that Lower Melville Wood will continue to be used as a waste transfer station and will continue to treat bulky wastes. Landfill restoration will take several years to complete, the gas engines (capturing landfill gas and generating electricity from it on site) will probably run for another 5-10 years and the site's leachate treatment facility will be needed for decades. There is also a recycling centre at the site in addition and a construction Material Recovery Facility where building and demolition waste is processed. At this point there are no plans to increase the footprint of the site.

Lochhead Landfill Site, North of Dunfermline

A13.96 Lochhead landfill has an anaerobic digestor on site, which provides heat to the Dunfermline heat network. The anaerobic digester plant processes the mixed green garden and food waste generated within Fife through the kerbside and recycling centres. It also has a household waste recycling centre and a Material Recovery Facility which processes waste generated within Fife and accepts recycling from other Local Authorities.

Thornton transfer station

A13.97 The Thornton facility is currently a waste transfer station and is expected to remain as such in the future. The transfer station gathers all sources of waste including household, business and construction for sorting and distribution to the correct disposal type. This ensures the waste is sent to the right place such as to biomass or incineration rather than ending up in landfill.

A13.98 More detail on the types of products in and out and waste in and out of the three sites Cireco that manage in Fife - Lochhead, Lower Melville Wood and Thornton is available in a summary document.

Incineration infrastructure

A13.99 Fife does not currently have enough incineration capacity to manage all the waste which is currently landfilled in the area. After the landfill ban, any waste that cannot be recycled or the materials recovered will be sent to one of two waste-to-energy incineration sites:

- Earls Gate in Grangemouth, providing 80,000 tonnes of capacity from late 2021

- Westfield in Fife will have a capacity of 250,000 tonnes from late 2023 (see note below).

Westfield, near Ballingry

A13.100 Westfield Energy Recovery Ltd are building an energy from waste plant on the former Westfield open cast site near Kinglassie. The facility will process non-hazardous waste and/or Refuse Derived Fuel from which the majority of recyclable material has been removed (this is known as residual waste). Planning permission has been granted and the facility is due to become operational in 2023.

Anaerobic digesters

A13.101 In anaerobic digestion organic waste is broken down by a natural process in sealed containers without any oxygen. Digestion usually occurs under a slow mixing process and produces biogas.

A13.102 The biogas is collected and can be used for any of the following:

- Refined further into biomethane for vehicle fuel or for injection into the gas grid;
- Burned in a combined heat and power engine to produce electricity and heat
- Burned in a gas boiler to produce heat for local use such as district heating or heat for an industrial process.

A13.103 There are two combined heat and power (CHP) waste facilities in Fife:

A13.104 Lochhead landfill site. This facility gained approval for an extension in April 2022. The digestor intake is biowaste including food, garden and commercial food waste. The energy created through biogas is channelled into the grid and the heat produced is used in the district heating system that covers Dunfermline with a predicted capacity of 1140kWe from a renewable source. It can accept up to 45,000 tonnes of waste per year.

A13.105 Diageo Cameronbridge facility near Leven. This uses brewery waste. This facility has a total capacity of 5,500kWe and requires up to 90,000 tonnes of waste to create this volume of energy.

A13.106 There are also two agricultural plants that use a combination of CHP and BtG (Biomethane to grid) technology using farming waste products and crops:

A13.107 Peacehill Farm, Wormit has an energy capacity of 237kWe and a biomethane of 550Nm3/h. The plant requires up to 30,450 tonnes of materials across both sources including rye, silage, poultry waste and potato outgrades.

A13.108 Inchdairnie Farm, Kinglassie uses specially grown crops such as rye, sugar beet and maize. The total capacity of this facility is 2,000kWe and 500m3/h biomethane. The total input volume is 40,000 tonnes of crops only, no waste is used at this plant.

A13.109 UK Anaerobic Digestion Sites Map - REA (r-e-a.net)

A13.110 These forms of sustainable energy generation use waste and natural materials for heat, energy and gas, taking biodegradable waste destined for landfill and getting the energy value out of it.

Biomass

A13.111 Fife Council owns and runs a total of 11 biomass boilers, six of which are located at either primary or secondary schools including Auchmuty High School, Levenmouth Academy and Lochgelly High School. Each of these biomass boilers are run using wood chip pellets rather than waste materials.

A13.112 In Scotland, there are currently only three major wood based biomass plants located in Irvine, Lockerbie and Markinch. Markinch biomass in Fife is run by RWE - the plant uses 450,00 tonnes of biomass fuel 90% is waste wood, the rest is made up of virgin wood that is sustainably sourced. The output of this biomass plant is used to renewably power the Glenrothes district heating network.

A13.113 The Westfield Biomass Plant is run by EPR Scotland and mainly incinerates chicken litter.

Recycling infrastructure in Fife

A13.114 There are recycling points located in most of Fife's towns and villages and there are 11 recycling centres to collect household waste spread throughout the area (see figure 13).

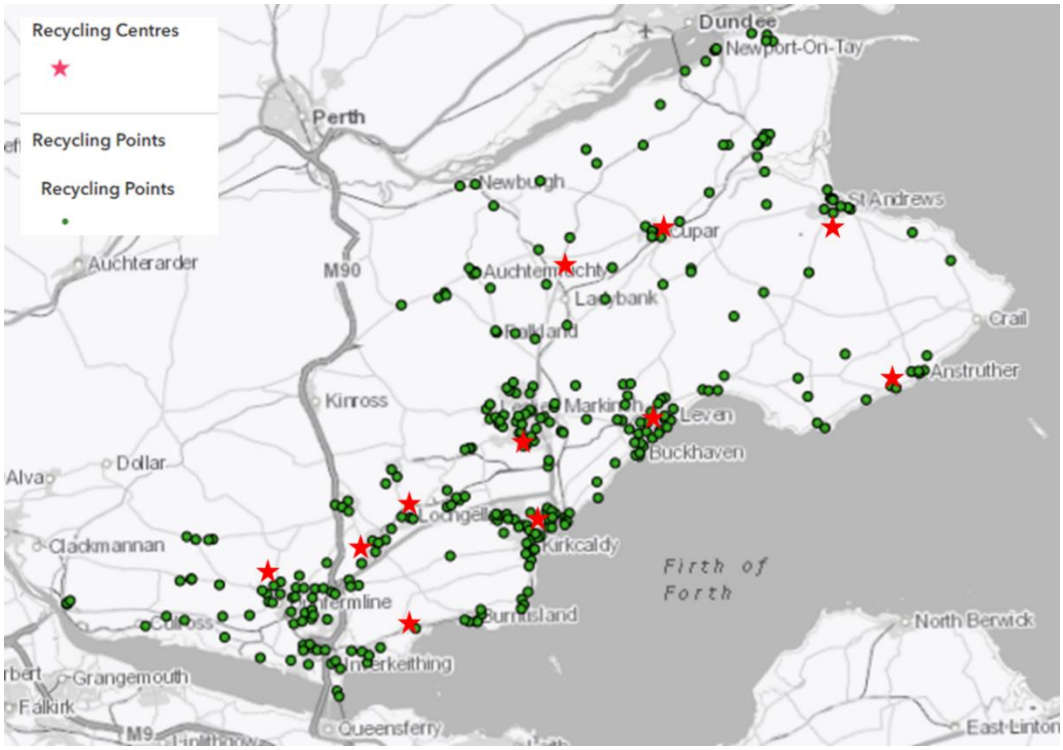


Figure 13: Map showing recycling points and centres across Fife. Source: Fife Council

A13.115 The majority of recycling points across Fife collect similar types of waste products from the kerbside collection system with the addition in some places of glass and textiles.

Specialist recycling facilities

A13.116 YES Glenrothes went bankrupt in early 2023 and went out of business. Other organisations are looking for places to set up different types of plastic treatment and recycling facilities so Fife should continue to promote itself as location for innovative technologies.

Reuse of products

A13.117 As well as increasing the number of recycling facilities for more specialised waste, the waste hierarchy prioritises the reduction and reuse of waste. The following Fife companies allow for the reuse of products. They are charities which reuse donated products:

- Castle Furniture, Cupar is a charitable organisation that provides donated furniture and other household goods for families across Fife.
- Furniture Plus has the same concept as Castle Furniture, serving the areas of Dysart and Dunfermline.

A13.118 Revolve is a quality standard to all second-hand stores, to ensure that all donated products (and the shop itself) are clean and safe for resale.

A13.119 Reuse is going to be a focus for work areas over the next few years and will feature again when the Resources Strategy is updated.

A13.120 Calculating embodied carbon

A13.121 Embodied carbon in the built environment refers to the carbon emissions emitted producing a building's materials, their transport and installation on a site as well as their disposal at end of life.

A13.122 The fundamental principle of an embodied carbon calculation is typically to multiply the quantity of each material or product by a carbon factor (normally measured in kgCO2 e per kg of material) for each lifecycle module being considered:

A13.123 Embodied Carbon = quantity of material X carbon factor

A13.124 The quantity of each material or product is an estimate that improves in accuracy throughout the design process.

A13.125 The carbon factors are split up by lifecycle module and are estimates that improve in accuracy as more is known about the procurement process for the project.

A13.126 As this is a straightforward calculation, the embodied carbon for an entire structure can be estimated quickly even at concept stage, allowing design options to be compared quantitatively alongside the other components of sustainable design.

Embodied carbon and construction

A13.127 Embodied carbon is captured in many different components of construction, the pie chart below from LETI climate emergency design guide illustrates the activities that makeup embodied carbon emissions.

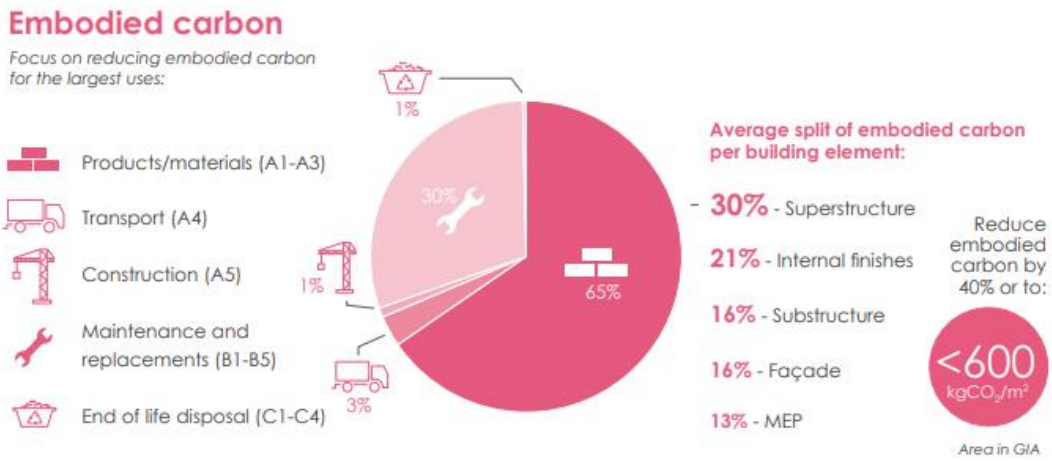


Figure 14: Example of embodied carbon in a school building

Source: LETI climate emergency design guide

A13.128 There are a vast range of actions that take place during construction which is why it can be challenging to calculate the embodied carbon, the diagram below is from the LETI climate emergency design guide. One of the biggest challenges is suppliers having the information to hand. For example, items like windows are made up of many different parts that have potentially travelled far to reach the supplier. Due to lack in methodology, there is no way of suppliers providing this information. In some cases, alternative recycled material can be used which will lower the embodied carbon.

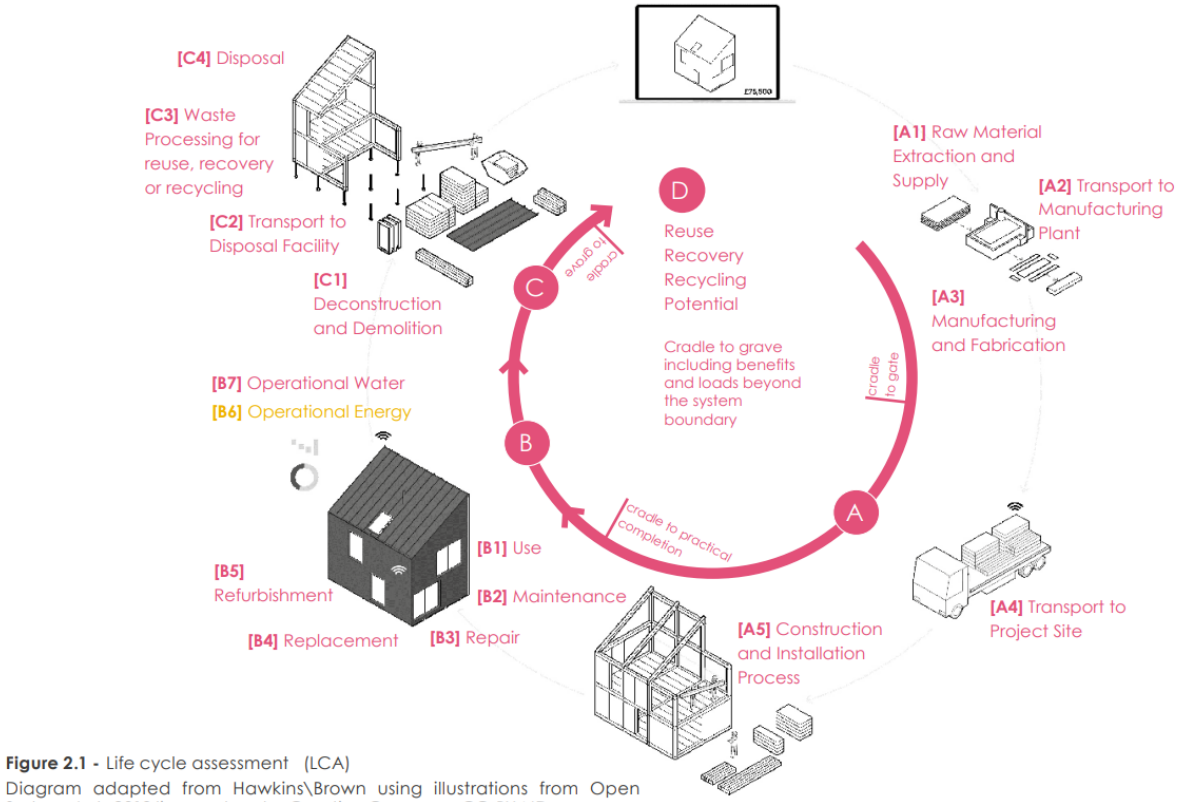


Figure 2.1 - Life cycle assessment (LCA)
Diagram adapted from Hawkins\Brown using illustrations from Open Systems Lab 2018 licensed under Creative Commons CC-BY-ND

Figure 15: Embodied carbon life cycle assessment diagram
Source: LETI climate emergency design guide

A13.129 As current regulations stand there are no requirements for developers to take into account embodied carbon. However, the Royal Institute of British Architects (RIBA) developed voluntary performance targets for operational energy use, water use and embodied carbon in the RIBA 2030 Climate Challenge report. This document aims to encourage architects and the wider construction industry to take action now.

RIBA 2030 Climate Challenge target metrics for domestic / residential

RIBA Sustainable Outcome Metrics	Business as usual (new build, compliance approach)	2025 Targets	2030 Targets	Notes
Operational Energy kWh/m²/y	120 kWh/m²/y	< 60 kWh/m²/y	< 35 kWh/m²/y	Targets based on GIA. Figures include regulated & unregulated energy consumption irrespective of source (grid/renewables). BAU based on median all electric across housing typologies in CIBSE benchmarking tool. 1. Use a 'Fabric First' approach 2. Minimise energy demand. Use efficient services and low carbon heat 3. Maximise onsite renewables
Embodied Carbon $kgCO_2e/m^2$	1200 $kgCO_2e/m^2$	< 800 $kgCO_2e/m^2$	< 625 $kgCO_2e/m^2$	Use RICS Whole Life Carbon (modules A1-A5, B1-B5, C1-C4 incl sequestration). Analysis should include minimum of 95% of cost, include substructure, superstructure, finishes, fixed FF&E, building services and associated refrigerant leakage. 1. Whole Life Carbon Analysis 2. Use circular economy strategies 3. Minimise offsetting & use as last resort. Use accredited, verifiable schemes (see checklist). BAU aligned with LETI band E; 2025 target aligned with LETI band C and 2030 target aligned with LETI band B.
Potable Water Use Litres/person/day	125 l/p/day (Building Regulations England and Wales)	< 95 l/p/day	< 75 l/p/day	CIBSE Guide G.

Figure 16: RIBA 2030 Climate Challenge target metrics for domestic/residential
Source: RIBA 2030 Climate Challenge version 2

Summary of Implications for the Proposed Plan

A13.130 The continued collaboration with the Council's waste management operations will be necessary to understand the policy requirements across the range of waste management activities. This will include a review of policies to accommodate the location of specialist plant and how land designated for a mix of uses may accommodate waste management at a smaller or local scale.

A13.131 The main implications of moving towards a circular economy for the Local Development Plan will be the need for additional waste management infrastructure to:

- sort and process recyclable materials which have been separately collected; and
- manage the remaining residual waste in a way which maximises resource value and minimises the impact of disposal on the environment.

A13.132 Approved NPF4 Policy 12 (Zero Waste) states that LDPs should identify appropriate locations for new infrastructure to support the circular economy and meet identified needs in a way that moves waste as high up the waste hierarchy as possible. Other elements of draft NPF4 include:

A13.133 Development proposals for energy-from-waste facilities will not be supported except under limited circumstances where a national or local need has been sufficiently demonstrated (e.g. in terms of capacity need or carbon benefits) as part of a strategic approach to residual waste management and where the proposal meets certain criteria.

A13.134 Across Fife and Scotland, more waste management facilities are likely to be required to meet the waste disposal demand without relying on landfill. This will require consideration in the LDP as land, services and access routes will be necessary. Also, the location and scale of new infrastructure needs to be considered, with consideration of whether a few larger sites or several smaller local-scale facilities will be needed. New policy may be required to support greater recycling and reuse of waste and new waste disposal innovations.

A13.135 The layout and design of future development will be a consideration in the development requirements and guidance for LDP2. Changes in practice and design will need to consider consequences for waste management collection and implications for the Council's waste management fleet.

A13.136 Development requirements are likely to need specified in the LDP to accommodate waste management changes as they are introduced.