

REPORT TO SUSTAINABILITY COMMITTEE – 30 NOVEMBER 2022

CARBON EMISSIONS FROM WASTE DISPOSAL

1 Executive Summary/Recommendations

1.1 The report presents detailed information to the Sustainability Committee as to the carbon impact generated by the different waste disposal methods currently available to Aberdeenshire Council and highlights the reduction in carbon impact once the residual waste is diverted from landfill to the NESS energy from waste facility once the build has been completed.

1.2 The Committee is recommended to:

1.2.1 Note the carbon impact for each waste disposal method and the saving in carbon emissions that will be created once the residual waste is diverted from landfill disposal to energy from waste; and

1.2.2 Note that the NESS Energy Project is exploring the feasibility of Carbon Capture Utilisation and Storage (CCUS) facilities as a means of reducing carbon impact from the NESS Energy from Waste facility.

2 Decision Making Route

2.1 Following a report to the Sustainability Committee on 15 June 2022 (Item 7) regarding an update on the UK Emissions Trading Scheme, a recommendation was agreed for Officers to submit a report on carbon emissions from Energy from Waste (EfW) facilities and waste disposal options in general.

3 Discussion

3.1 Recent Scottish Government consultations on Delivering Scotland's Circular Economy with regards to the Route Map to 2025 and beyond and the Circular Economy Bill (consultation responses reported to the Sustainability Committee 25 September 2022, Item 5) have focused on proposed measures that will have an impact in meeting several key principles, notably the commitment to achieve net zero by 2045 and align with the EU, and the need to reduce the material footprint of our resources and waste by maximizing the value of the circular economy.

3.2 The carbon metric impact (Zero Waste Scotland) is a measure of the whole-life carbon impacts of waste. Approximately 90% of the carbon impact of Scotland's waste is produced before disposal, during resource extraction, manufacturing, and transport. Proposals in the consultation for the Route Map to 2025 and beyond considered how products are designed and manufactured to increase how long a product will last, whether they can be reused or repaired, and how easily they can be recycled which can reduce the carbon impact of Scotland's waste.

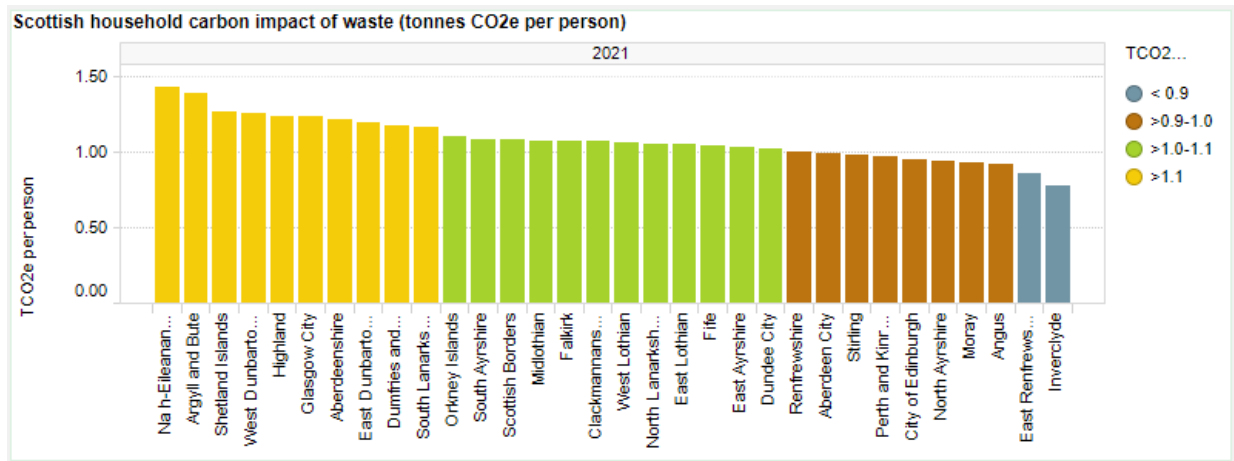
- 3.3 Zero Waste Scotland have compiled carbon factors (CFs) to quantify the whole-life carbon impact of Scotland's waste and this is included at **Appendix 1** ([ZWS Carbon Metric Factors 2011-2020 V02.00.xlsx \(live.com\)](#)). The carbon factors are measured using a life cycle thinking approach and include the production (waste generated) through to the waste disposal impact which includes transport emissions from collection, waste management process emissions and disposal. Avoided production impacts are also included when waste is prevented and recycled.
- 3.4 Table 1 (below) details the carbon impact of household waste generated and managed by Aberdeenshire Council and compares this to its impact by weight. This is based on the SEPA data for 2021 calendar year for household waste generated in Aberdeenshire which was published on 28 September 2022.

Table 1. Waste Generated and Managed by Aberdeenshire Council in 2021

Activity	Tonnes		Carbon	
	Impact (tonnes)	Proportion of waste generated (%)	Impact (tCO ₂ eq)	Proportion of waste generated (%)
Waste generated	117,505		314,558	
Recycled	48,268	41.1%	-27,598 ¹	-8.8%
Incinerated	2,945	2.5%	718	0.2%
Landfilled	66,292	56.4%	29,669	9.4%

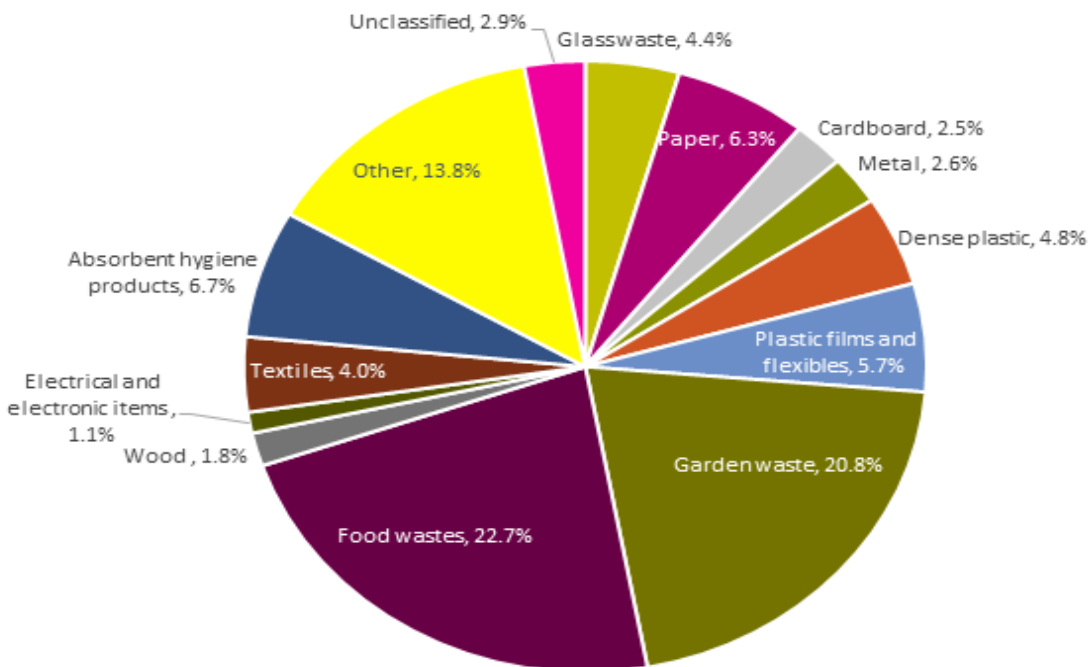
- 3.5 Household waste makes up approximately 21% of Scotland's waste by weight, but 55% of the total waste carbon emissions.
- 3.6 In 2021, the total waste produced per person for Aberdeenshire was 450kg (0.45t), which had a carbon impact of 1.21 tCO₂e (7th highest local authority in Scotland – see Figure 1 overleaf). For comparison, the average figures for Scotland were 0.45t per person of waste produced with an impact of 1.08 tCO₂e – highlighting that Aberdeenshire is above the Scottish average for carbon impact per person for waste disposal. The difference in carbon impact per person is in part due to the recycling tonnage per person being less for Aberdeenshire (0.18t per person for Aberdeenshire compared to 0.19t per person as an average for Scotland) however the main factor is due to the higher tonnage of waste being disposed of to Landfill by Aberdeenshire compared to other local authorities who have a higher disposal tonnage in the category of Other Diversion, being disposal by energy from waste. **Appendix 2** summarises the Scottish household waste generated and managed per person in 2021, as published by SEPA ([Household Waste \(sepa.org.uk\)](#)).
Figure 1 Scottish Household Carbon Impact of Waste 2021

¹ A negative value for carbon indicates a net saving in impact. Recycling creates secondary material which can be used to replace virgin material extraction and production, saving associated emissions. It is these savings which are often the main environmental benefit of recycling.



3.7 The recent residual waste composition analysis carried out for Aberdeenshire has shown that on average almost 68% of the residual waste bin could have been recycled either through the kerbside recycling service or recycling centres and points. This material instead ended up in landfill which contributes to a higher carbon impact, especially material streams such as food, garden waste, wood, paper, cardboard and textiles which accounted for 58% of the residual waste bin in total – Figure 2 below shows the analysis of the residual waste bin from the 3 week sampling programme which included sampling waste from 749 households across the whole of Aberdeenshire.

Figure 2: Overall composition of residual waste in Aberdeenshire



3.8 The introduction of the improved recycling service from March 2023 will encourage residents to consider the resources they are throwing away in the residual waste bin. By reducing the collection frequency of the residual waste

bin (therefore reducing capacity) whilst increasing recycling capacity and quality by providing an additional recycling bin to split the mixed recycling stream, this will divert material streams that could be recycled from the restricted residual waste bin into the recycling containers provided at the kerbside or at the recycling centres and points. This is expected to divert between 1,249 – 6,434 tonnes of material from disposal into recycling and could reduce the carbon impact on waste disposal to landfill by up to 2,908 tCO₂e if the maximum tonnage is diverted. This does not include the negative carbon impact with regards to the recycling/composting element of the diverted waste which would offset the total carbon impact. This amount would depend on the tonnages that were sent for each different material stream for recycling/composting however using an average based on a general household stream this could save a further estimated 4,442 tCO₂e therefore in total an estimated carbon saving of 7,350 tCO₂e if the maximum tonnage is diverted from landfill to recycling/composting.

- 3.9 Food waste is a global problem that has significant economic, environmental, and societal impacts. Almost one million tonnes of food and drink is thrown away every year in Scotland, with food wasted in the household representing around 20% of all food purchased in Scotland by weight. In 2018 food waste generated 2.648 million tonnes CO₂e accounting for 3.8% of Scotland's total carbon footprint. The recent residual waste analysis highlighted that almost 23% of the residual waste was food waste. Tackling food waste by preventing and recycling is one of the most important ways we can reduce the carbon impact of our waste.
- 3.10 A study carried out by Zero Waste Scotland in 2018 identified that, on average, disposal via energy from waste carbon impacts was 15% lower than landfill when considering one tonne of residual municipal waste based on full life carbon impact. Based on the category Household and Similar Wastes, an average tonne of residual municipal waste has a carbon impact of 0.452 tCO₂e when disposed of to landfill compared to 0.382 tCO₂e when disposed of through energy from waste, providing a carbon reduction of 0.07 tCO₂e per tonne to divert from landfill to energy from waste. Based on an approximate annual amount of 70,000 tonnes of residual waste going to landfill that is managed by Aberdeenshire Council (both household and commercial waste), this should see a carbon impact saving of approx. 4,900 tCO₂e when disposal option changes to energy from waste.
- 3.11 It should be noted that the carbon data in this report is based on the carbon metric impact tool from Zero Waste Scotland which is utilised by SEPA in reporting the full impact of waste generated in Scotland and is aimed at better understanding the impacts of different waste management options as it considers the emissions from the production of the waste right through to the disposal including transport emissions from collecting and transporting the waste, the emissions from the disposal method e.g. landfill, combustion of waste, recycling, etc., as well as relative carbon intensity of the electricity generated at an EfW compared to the marginal carbon intensity of the grid. The aggregated landfill emissions tCO₂e has been identified through sources including the UK Greenhouse Gas Inventory, WRATE (the Waste and

Resources Assessment Tool for the Environment), and IPCC (Intergovernmental Panel on Climate Change). The latest assumptions around methane capture are that on average 62% methane is captured, and of this 57% is used for energy generation with 4% assumed to be oxidised at the cap.

- 3.12 The climate change reporting by the Sustainability team is managed by Sustainability Scotland who use the Department for Business, Energy & Industrial Strategy (BEIS) Greenhouse Gas Conversion Factors for carbon impact which differs from Zero Waste Scotland carbon metric factors based on what is being considered for each analysis. The BEIS factors are provided to support company reporting and therefore do not take into account the full impact from waste generation and disposal and relates only to the activity that the reporting company carries out. For Aberdeenshire Council reporting, this means that the carbon impact being reported in relation to the waste being produced by the Council includes the collection of the waste and recycling streams, and onward transportation to the disposal/recycling facility, however only the emissions from landfill are included in the BEIS factors with the carbon impact of waste generation, recycling, diversion and combustion not being included as a factor in the Council reporting as it is the responsibility of the companies that are generating the waste and disposing/recycling/incinerating the waste to report on the carbon impact of those activities. The BEIS reporting for 2020 therefore shows an increased difference of tCO₂e between landfill and EfW disposal when compared with ZWS carbon reporting. The BEIS carbon impact factors show an average tonne of residual municipal waste having a carbon impact of 0.437 tCO₂e when disposed of to landfill compared to 0.021 tCO₂e when disposed of to energy from waste giving a difference of 0.416 tCO₂e per tonne due to the BEIS factors comparing the carbon impact of landfill waste disposal which includes transport emissions and landfill emissions against energy from waste disposal which only includes the transport emissions.
- 3.13 As from late Spring 2023, the Council's residual waste will be sent to the NESS energy from waste facility instead of landfill, therefore complying with the landfill waste ban from 1 January 2026 and reducing the carbon impact from waste disposal.
- 3.14 The development of the waste route map in Scotland will set out the strategic direction for the management of residual waste up to 2045 for achieving net zero and will consider restrictions with regards to what waste streams will be accepted for energy from waste. It is a possibility that the plan will restrict the incineration of fossil materials and require the removal of more plastics from the energy from waste input stream which will either be by improved source segregation by the Council or the requirement for pre-treatment of residual waste to remove plastics. The Council are currently trialing a collection of rigid plastics at two Household Recycling Centres as part of a feasibility study into increasing plastic recycling options.
- 3.15 In support of the UK and Scottish Government's commitment to decarbonise the economy, the UK government has been consulting on when to include energy from waste in the UK Emissions Trading Scheme (UK ETS). Should

this happen, it will significantly increase the costs of operating the NESS Energy facility. An option to reduce the emissions produced by the facility, and also reduce any financial impact from inclusion in the UK ETS, would be to consider carbon capture. Carbon capture would reduce the overall emissions generated by the NESS Energy facility with the potential to be carbon negative.

- 3.16 The UK Government recognises that Carbon Capture Utilisation and Storage (CCUS) facilities are part of the Net Zero solution and is developing a financial support mechanism to support the development of CCUS clusters in the UK with the potential for a Scottish cluster being progressed with the consequential opportunity for NESS Energy to be a supplier to the cluster if a case can be made.
- 3.17 Post-combustion carbon capture technologies could be integrated in the flue gas path at the tail-end of the EfW plant and is the most practical technology for retrofit installation of CO₂ capture at NESS Energy Project. Captured CO₂ would be required to be transported from the EfW plant to the final storage/utilisation destination to ensure a net reduction of CO₂ emissions to atmosphere.
- 3.18 There are currently no end-storage locations in operation and ready for receiving CO₂ for storage at large scale however several CO₂ storage projects are currently under development in the UK and North Europe, with the UK government recently announcing funding for the two CCUS clusters in the north of England which are considered to be deployed by mid- 2020s. St Fergus (Acorn) facility is also being developed to connect to CO₂ storage under the North Sea and should a Scottish cluster be developed then it would feed CO₂ to the redundant oil and gas fields in the North Sea. A further option would be the Northern Lights project in Norway.
- 3.19 In order to be in a position to take advantage of this opportunity a detailed feasibility study is to be developed for considering CO₂ capture at NESS Energy Project.

4 Council Priorities, Implications and Risk

- 4.1 This report helps deliver the Strategic Priorities “Infrastructure” within the Pillar “Our Environment” and “Economy & Enterprise” within the Pillar “Our Economy” by utilising the key principles of responsible finances; climate and sustainability; and economy when considering the carbon impact of disposal methods and the costs associated with this.
- 4.2 Considering carbon emissions from waste disposal options would support the delivery of one of the Council’s Priorities “Provision of a waste and recycling services that supports our attractive environment and reduces emissions”. This priority is also included in the Infrastructure Services Directorate Plan 2020-22.
- 4.3 The table below shows whether risks and implications apply if the proposed options are agreed.

Subject	Yes	No	N/A
Financial			x
Staffing			x
Equalities and Fairer Duty Scotland			x
Children and Young People's Rights and Wellbeing			x
Climate Change and Sustainability			x
Health and Wellbeing			x
Town Centre First			x

4.4 There are no staffing or financial implications with regard to reporting on carbon emissions from waste disposal options.

4.5 The screening section as part of Stage One of the Integrated Impact Assessment process has not identified the requirement for any further detailed assessments to be undertaken. This report on carbon emissions from waste disposal is only for providing information and data to Committee on the carbon emission impact based on disposal options and is not proposing any activity or policy that would require assessment.

4.6 The following Risks have been identified as relevant to this matter on a Corporate (Corporate Risk Register):

- ACORP002 Changes in government policy, legislation and regulation in that potential changes in legislation by way of the Circular Economy Bill which is due to go before parliament by summer 2023 and any future legislative changes could have an impact on carbon factors used for reporting purposes. This is an ongoing risk that the Service has to adapt to with regards to any changes in legislation.

5 Scheme of Governance

5.1 The Head of Finance and Monitoring Officer within Business Services have been consulted in the preparation of this report and their comments are incorporated within the report and are satisfied that the report complies with the [Scheme of Governance](#) and relevant legislation.

5.2 The Committee is able to consider this item in terms of Section R paragraphs 1.1a and 1.1c of the List of Committee Powers in Part 2A of the Scheme of Governance as it relates to approving, reviewing and monitoring the Council's work in respect of sustainable development and climate change and promoting awareness of the need for sustainability within the Council and the wider community of Aberdeenshire.

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Report prepared by Diane Rotherham, Strategy Development Officer (Waste)
Date: 18 November 2022

List of Appendices:

Appendix 1 - Zero Waste Scotland Carbon Metric Factors (2020)

Appendix 2 - Scottish Household waste data summary 2020 (SEPA)