



**Scoping policy options
for Scotland focusing on
understanding and managing
the environmental impact
of single use e-cigarettes**

Summary Report

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June 2023

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1 Report Headlines

This report presents possible high level policy options to reduce the disamenity and pollution impact and enhance the safe recycling of single use e-cigarettes (SU-ecigs). To provide context it examines the environmental impacts and current market and use of SU-ecigs, and the projections of use without intervention. Please note, this report uses estimates based on extrapolations from a range of sources. For full details of how the author has estimated data and data projections, please see section 4.1 of the Detailed Technical Report.

1.1 Market and Use

In the year ending January 2023, we estimate there were 543,000 users of e-cigarettes in Scotland (10.8% of the adult population) of which 51,000 (9%) were under 16, and 78,000 (14%) were under 18.¹ Very recent data on youth vaping suggest that vaping is now more common than smoking cigarettes, with almost one in five (18%) adolescents reporting having used an e-cigarette at least once in their lifetime.²

Sales of SU-ecigs have grown extremely quickly over the last two years. Sales revenue from SU-ecig sales through grocery outlets doubled between October 2022 and March 2023.³

The propensity to adopt SU-ecigs as the main form of e-cigarette use is much higher in the young. We estimate that around 67% of users in Scotland, as of 2022, were under 25.⁴

In the absence of any intervention, we can expect:

1. Continued growth in the uptake of e-cigarettes across the population of Scotland,
2. A rising share of SU-ecig users (and share of sales revenue) among the growing number who use e-cigarettes, and
3. A high share of SU-ecig users being teenagers.

¹ These are the author's own estimations based on extrapolation from calculations based on population data from the census, and data from Vera Buss, Loren Kock, Robert West, Emma Beard, Dimitra Kale, Jamie Brown (2023) Trends in electronic cigarette use in Scotland, for Smoking in Scotland, updated April 2023; Vera Buss, Loren Kock, Robert West, Emma Beard, Dimitra Kale, Jamie Brown (2023) Trends in electronic cigarette use in England, for Smoking in England, updated April 2023; Scottish Government (2023) Health and Wellbeing Census Scotland: 2021/22. Experimental Statistics: Statistics under Development, 28 February 2023, and Supplementary Tables; Action on Smoking and Heath (ASH) (2022) Use of e-cigarettes (vapes) among adults in Great Britain, August 2022 and Action on Smoking and Heath (ASH) (2022) Use of e-cigarettes (vapes) among young people in Great Britain, July 2022; Tattan-Birch H, Jackson SE, Kock L, Dockrell M, Brown J. (2023) Rapid growth in disposable e-cigarette vaping among young adults in Great Britain from 2021 to 2022: a repeat cross-sectional survey. *Addiction*. 2023;118(2):382–6. <https://doi.org/10.1111/add.16044>. See section 4.1 of the Detailed Technical Report for full details.

² University of Glasgow - Schools - School of Health & Wellbeing - Research - MRC/CSO Social and Public Health Sciences Unit - Research - Complexity in health - Health Behaviour in School-aged Children (HBSC) Scotland Study, June 2023.

³ Data provided by IBVTA based on data from NielsenIQ, for details see section 4.1 of the Detailed Technical Report.

⁴ For details of the author's calculations for this estimate, see section 4.1 of the Detailed Technical Report.

1.2 Environmental Impacts

A range of environmental issues have been linked to the use of SU-ecigs and the way they are designed, manufactured and discarded.

- The lithium polymer batteries used in some of the most popular e-cigarettes could be recharged 500 times if the product allowed for such;
- The total emissions associated with SU-ecigs in 2022 was estimated to be between 3375 and 4292 tonnes CO₂e;
- Water use linked to the manufacture of SU-ecigs was estimated to be between 18761 and 23877 m³ in 2022;
- Despite limited data it is estimated that around 10% of SU-ecigs are littered. In 2022 this was between 21 and 79 tonnes.

Both the environmental impacts and health issues for young people are of concern around SU-ecig use worldwide. A number of jurisdictions have already introduced, or are considering introducing, bans on sales, whilst some have banned only flavoured e-cigarettes. Action on limiting the use of SU-ecigs has so far been largely driven by health concerns, however, as the SU-ecigs have increased their market share, so the environmental concerns are becoming more prominent in the minds of the public.

1.3 Shortlist of Policy Options

This summary report presents a shortlist of the following potential nine high level policy options to be considered further by Ministers, from which Scottish Government could prioritise further policy work to address the environmental impacts of SU-ecigs. More details of these nine options and a review of a wider set of potential policy options is considered in the detailed technical report.

The environmental impacts identified could be significantly reduced through:

Policy Option 1

Setting design criteria for e-cigarettes.

Policy Option 2

Requiring that batteries can be removed and be replaced (potentially to all WEEE items).

Policy Option 3

A ban on the sale of SU-ecigs.

Policy Option 4

Charging a deposit for SU-ecigs to be refunded on return for recycling.

Policy Option 5

A tax linked to recycling performance.

Policy Option 6

Changes in the WEEE Regulations relating to the scope of cost recovery, a separate WEEE category for e-cigarettes, costs of management of e-cigarettes and setting targets.

Policy Option 7

A levy or charge on sales payable by the consumer.

Policy Option 8

A ban on flavoured e-cigarettes.

Policy Option 9

Tightening of enforcement of existing law in relation to underage sales.

All the above policy options have the potential to influence environmental outcomes, though for some options, combining them with others would be expected to enhance their impact.

2 Introduction

There are growing concerns regarding the environmental impact of single-use e-cigarettes, in particular in relation to the implied level of resource use, and the potential consequences of failing to ensure safe and responsible management of them once they become waste.

At the request of the Minister for Green Skills, Circular Economy & Biodiversity, Zero Waste Scotland oversaw a review of the environmental impact of and potential policy options for improving the management of single use e-cigarettes, reducing the disamenity and pollution impact, and enhancing the safe recycling of these discarded products.

The review looks at possible options from a range of perspectives. The review is not intended to be a full impact and policy assessment, it is a high-level review of potential options to inform Ministers and from which Scottish Government will prioritise further work. This is a summary report highlighting the main findings. There is also a detailed technical report available that provides greater detail on policy options considered, environmental impact and market and use data.



THE RAPID INCREASE IN SU-ECIG USE IS GIVING RISE TO ENVIRONMENTAL CONCERNS, AND POSES CHALLENGES FOR RESPONSIBLE END-OF-LIFE MANAGEMENT

3 Terminology

The language surrounding the products that are the subject of this work is evolving almost as quickly as the market itself.

The word ‘vape’ is a reasonable term to apply to the act of using the products concerned: as a verb, and indeed, the term ‘vaping’ is a sensible way to delineate the activity from ‘smoking’, conventional cigarettes.

The noun “vape” is also in common use, but “e-cigarette” is the term used in Guidance on Waste Electrical and Electronic Equipment (WEEE), and is the term adopted for use in this report.

It is also necessary to delineate the boundary between ‘single-use’, ‘disposable’ ‘other’ e-cigarettes. All ‘single-use’ e-cigarettes are designed for more than a single puff, but they are not designed to be recharged or refilled. Once the liquid contained in the device is expended, it no longer has a use. The battery can also not be replaced.

Single-use e-cigarettes are referred to as SU-ecigs in this report. ‘Other’ e-cigarettes, discussed in this report, are referred to as rechargeable e-cigarettes (Rch-ecigs) and refillable e-cigarettes (Rf-ecigs). The former are defined as e-cigarettes designed to be used so that the vaped liquid is contained in pre-filled containers/cannisters that can be replaced a number of times. The latter are defined as e-cigarettes designed to be used so that the vaped liquid is contained in a container/cannister that the user can fill and refill using bottles/containers of suitable liquid which are poured into the container/cannister.



Credit: Laura Young @lesswastelaura

4 Market and Use

4.1 How Many People Use E-cigarettes in Scotland

We estimate that, in the year 2022:¹

- 10.8% of the adult population, and 22% of those aged under-18 were users of e-cigarettes
- Of those e-cigarette users, more than a quarter (27%) are estimated to be users, mainly, of single-use e-cigarettes (SU-ecigs)
- The propensity to adopt SU-ecigs as the main form of e-cigarette use is much higher in the young – in the under 18s, 59% of e-cigarette users are mainly users of SU-ecigs, with the figure being only slightly lower (56%) in the under 18-24 age bracket.

In the 52 weeks to early April 2023, the number of SU-ecigs consumed in Scotland was estimated to be between 21 and 26 million units.

A very recent report by the University of Glasgow estimates that almost one in five (18%) adolescents reporting having used an e-cigarette at least once in their lifetime. Rates were higher among older adolescents: 4% of 11-year-olds and 16% of 13-year-olds compared to 36% of 15-year-olds.⁵

4.2 Trade

The vast majority of all SU-ecigs are manufactured in China. A small amount of manufacturing may occur in the UK, though we are not aware of manufacturers of SU-ecigs based in Scotland (which should not be taken to imply there are none, but if there are any, their market share is currently small).

Other than importing, distribution and retail, economic activity in the UK is likely oriented more towards higher value refillable e-cigarettes (Rf-ecigs), as well as the liquids used in e-cigarettes. The extent of UK-based activity merits further investigation.

⁵ University of Glasgow - Schools - School of Health & Wellbeing - Research - MRC/CSO Social and Public Health Sciences Unit - Research - Complexity in health - Health Behaviour in School-aged Children (HBSC) Scotland Study, June 2023.

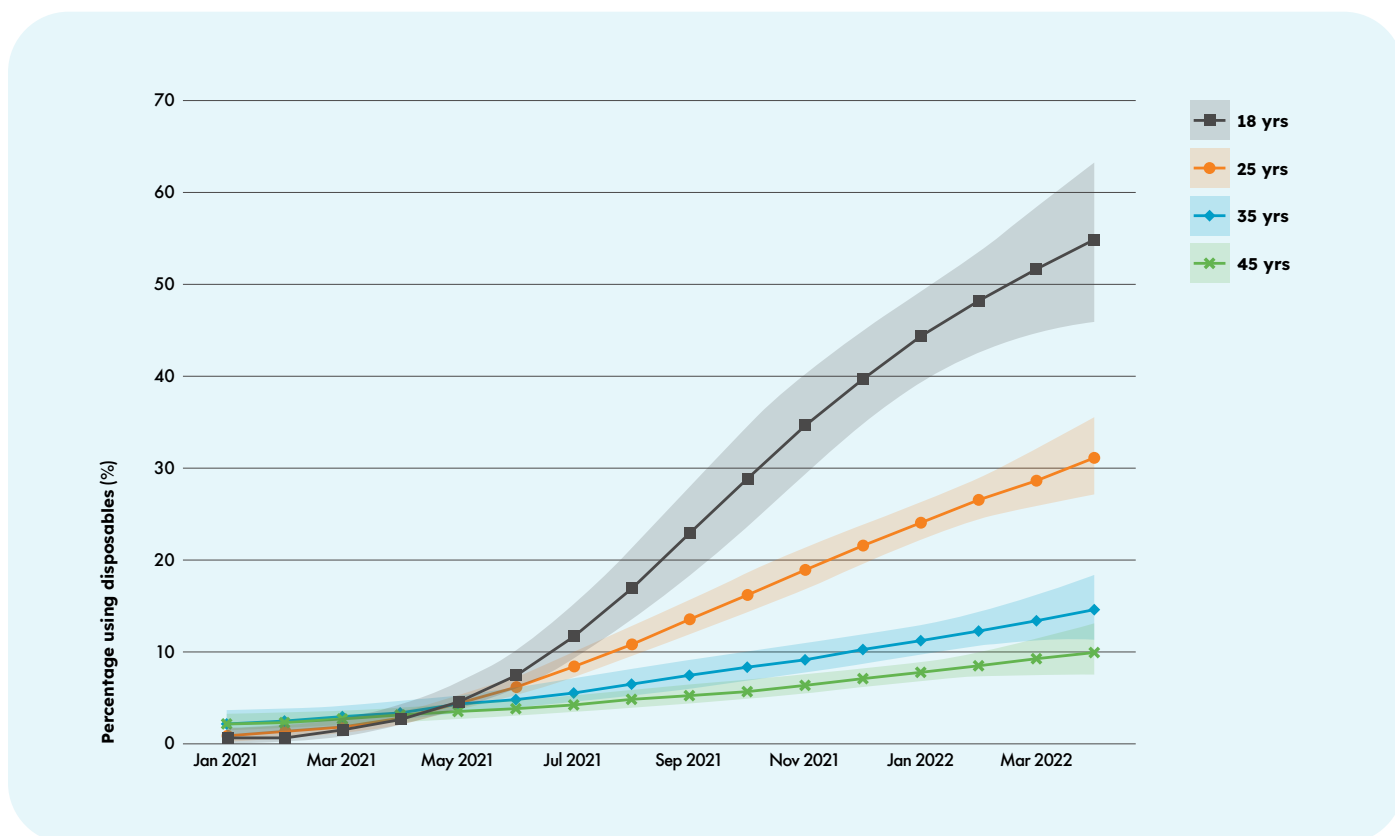
4.3 Projections for Future Use

Data highlights that sales of SU-ecigs have grown extremely quickly over the last two years. Rolling 12-month figures for SU-ecig sales from grocery outlets indicate that sales revenue more or less doubled between October 2022 and March 2023.

This has been reflected in the evolution in the proportion of vapers using SU-ecigs, as indicated in Figure E-1.

It would be difficult to justify – statistically – a forward projection for five years based on extrapolation from a very short-term trend.

Figure E-1. Percentage of current vapers using disposable e-cigarettes across ages in Great Britain from 2021 to April 2022



Note. A total of 36,876 eligible adults were surveyed (approximately 2300 each month). Lines represent point estimates from logistic regression allowing an interaction (between age and month, modelled non-linearly using restricted cubic splines (three knots). Shaded areas represent standard errors. Source: Tattan-Birch H, Jackson SE, Kock L, Dockrell M, Brown J. (2023) Rapid growth in disposable e-cigarette vaping among young adults in Great Britain from 2021 to 2022: A repeat cross-sectional survey. *Addiction*. 2023;118(2):382-6. <https://doi.org/10.1111/add.16044>

We think it reasonable to consider that, in the absence of any intervention, key changes to be expected are:

1. Continued growth in uptake of e-cigarettes across the population of Scotland; and
2. Alongside this growth, a rising share of SU-ecig users (and share of sales revenue) among the growing number who use e-cigarettes.

Projection figures are our own estimations based on extrapolation from several datasets (see Section 4.1 of Detailed Technical Report), and based on the following assumptions:

- Uptake of e-cigarettes in the under 16s increasing by 2 percentage points per annum (just below the rate of growth for 13year olds, and well below half the rate for 15 year olds)⁶
- Uptake in the adult population increasing by 1.5 percentage points per annum, i.e., 1.5% of the adult population are added to the number of e-cigarette users in each year (half the rate of the year to 2022)⁷
- Increase in the proportion of e-cigarettes users whose main device is SU-ecigs of 4% per annum (of e-cigarette users in the age-bracket) across the under 16s, the 16-24 age bracket, and the 25-34 age bracket
- Increase in the proportion of e-cigarettes users whose main device is SU-ecigs of 2% per annum (of e-cigarette users in the age-bracket) across those aged 35 and upwards
- The number of SU-ecig units purchased

per annum, expressed per person for whom SU-ecigs are the main device used, remains constant⁸

The resulting user numbers are shown in Figure E-2. The resulting projection for units consumed is shown in Figure E-3. Note that these projections could yet prove to be conservative: extrapolation on the basis of a short time-series in the recent past, though, was not considered justifiable.

- We estimate that in the year ending January 2023, there were 543,000 vapers in Scotland of which we estimate 51 thousand (9%) were under 16, and 78 thousand (14%) were under 18. Without intervention, this could rise to over 900,000 users by 2027.
- The number of SU-ecigs consumed in Scotland in 2022 is estimated to be between 20.6 and 26.3 million units. Without intervention, this could rise to between 50 and 64 million units by 2027.

⁶ Based on Scottish Government (2023) Health and Wellbeing Census Scotland: 2021/22. Experimental Statistics: Statistics under Development, 28 February 2023, and Supplementary Tables.

⁷ Vera Buss, Loren Kock, Robert West, Emma Beard, Dimitra Kale, Jamie Brown (2023) Trends in electronic cigarette use in Scotland, for Smoking in Scotland, updated 20th January 2023

⁸ Both this and the previous rate are conservative if one considers the evidence in Tattan-Birch H, Jackson SE, Kock L, Dockrell M, Brown J. (2023) Rapid growth in disposable e-cigarette vaping among young adults in Great Britain from 2021 to 2022: a repeat cross-sectional survey. *Addiction*. 2023;118(2):382–6.

<https://doi.org/10.1111/add.16044>

Figure E-2. Projections for users of E-cigarettes and SU-ecigs

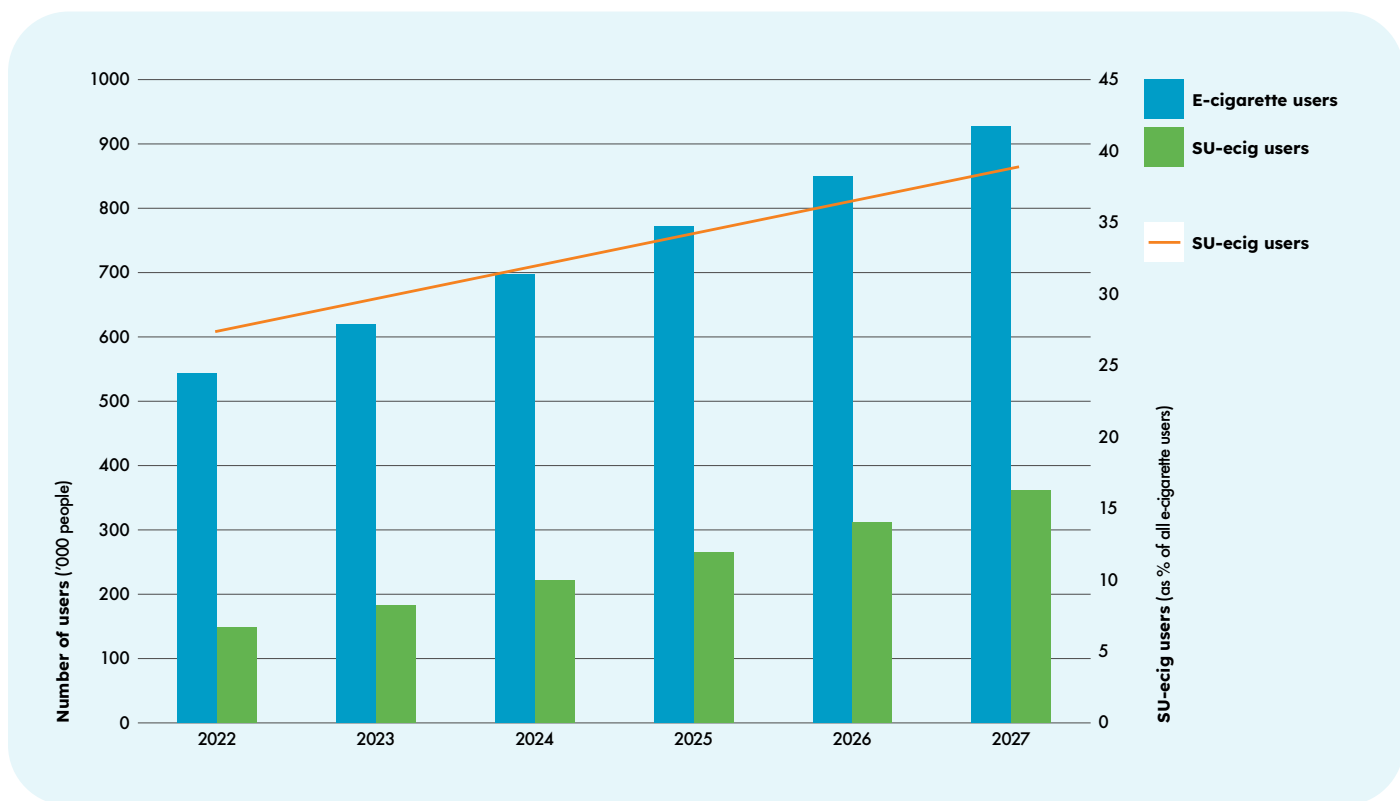
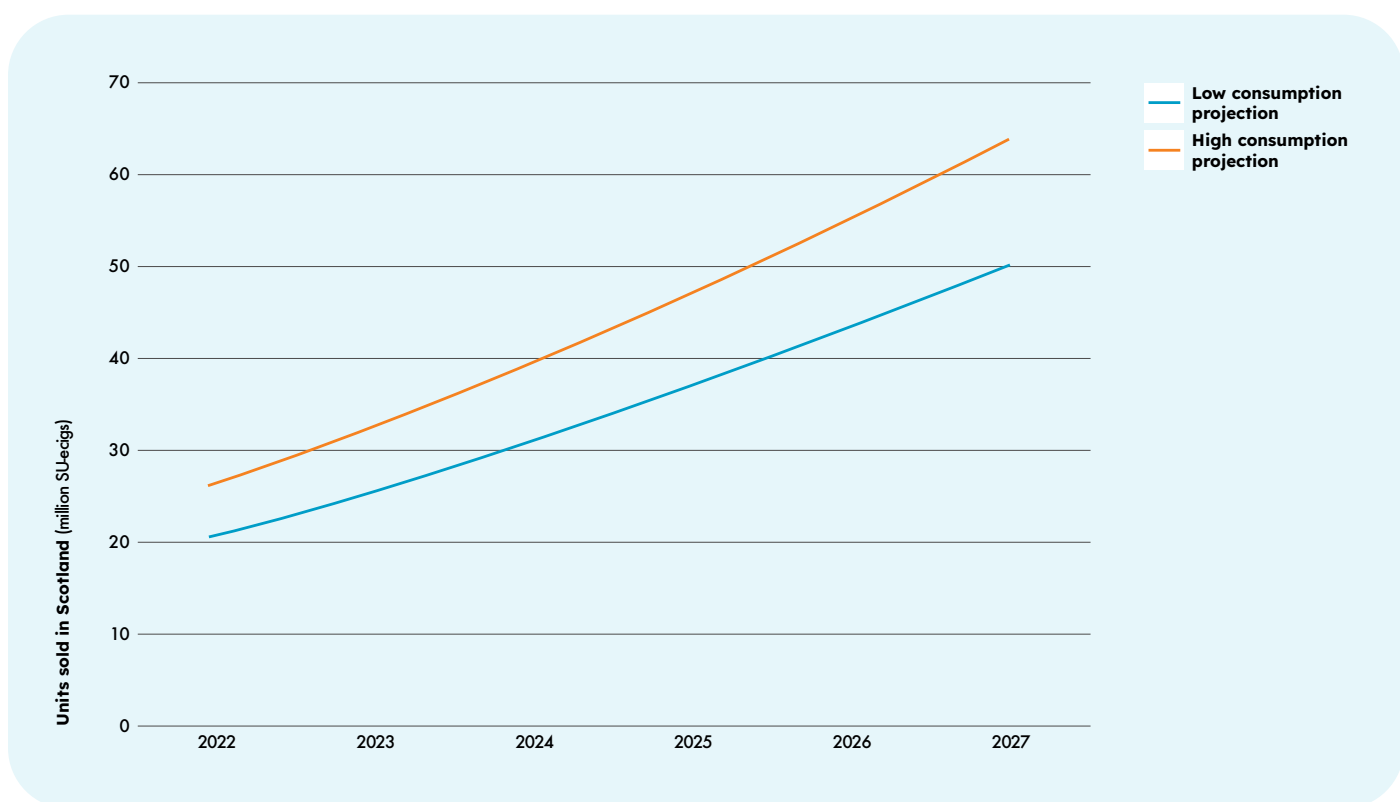


Figure E-3. Projection for consumption of SU-ecigs in Scotland



5 Environmental Concerns

5.1 Content of SU-ecigs

E-cigarettes contain a wide variety of materials in their casings, liquid and packaging:

- Casings may be plastic polymer or metal
- Mouthpiece is usually plastic
- Fillers are usually non woven synthetic fibres
- Coils are usually kanthal, or nichrome, or another metal alloy
- The battery is in the most popular brands is a lithium-ion polymer (LiPo) battery that could be recharged
- Some SU-ecigs include LEDs
- SU-ecigs also contain a small (hot film flow) sensor that detects air flow and activates the heating element
- Common metals in the components of e-cigarette products include aluminium, barium, cadmium, chromium, copper, iron, lead, nickel, silver, tin, and zinc
- SU-ecigs are often packaged first, in metallised film, and then, in a cardboard box (which in some cases appears to have a film cover of plastic or other material). Inside the metallised film, some (we do not know the proportion) SU-ecigs have silicon covers for the top and bottom of the device
- SU-ecigs may contain Brominated Flame Retardants or other organophosphate flame retardants
- Most liquids in SU-ecigs contain mainly glycerin (glycerol) and propylene glycol (PG), as well as nicotine, and other additives (including for flavouring)



A range of environmental issues have been linked to use of SU-ecigs and the way they are discarded:⁹

1. Wasteful use of resources;

- The average full weight of a SU-ecig was estimated, conservatively, at 32g, of which on average 10.8g is the battery, 9.5g plastic, 6.5g steel, 1g cotton wick, 1g cellulose material, and small amounts of critical metals
- The lithium polymer batteries used in some of the most popular e-cigarettes could be recharged 500 times if the product allowed for such

2. The impact of consumption in terms of embodied greenhouse gas emissions, and energy use;

- The emissions associated with production of the battery are estimated to be 84g CO₂e
- The emissions associated with the remaining materials are estimated to be 68g CO₂e
- The emissions associated with packaging are estimated to be 12g CO₂e are emitted

- The total emissions associated with SU-ecigs in 2022 were estimated to be between 3375 and 4292 tonnes CO₂e (excluding the emissions associated with manufacture)

3. Littering of SU-ecigs (and the possible consequences thereof – see below).

- 4. The impact of improperly discarding SU-ecigs so that they are not capable of being recycled, (they are being sold as 'disposable' devices);**

- It is estimated that somewhere between 721,000 and 2,787,800 units were littered in Scotland in 2022

5. Potential fire risks posed for waste managers.



⁹ Materials Focus (2023) Vapes Briefing, last updated 23 January 2023; House of Commons Library (2022) The environmental impact of disposable vapes, 28 November 2022; Scottish Parliamentary Briefing by the Marine Conservation Society, ASH Scotland, Keep Scotland Beautiful, Laura Young and Elliott Welch (2023) Tackling the environmental and health impacts of e-cigarettes, January 2023; Wildlife and Countryside Link (2023) The Environmental case for Banning Disposable Vapes - Wildlife and Countryside Link briefing - March 2023; Beutel, M.W.; Harmon, T.C.; Novotny, T.E.; Mock, J.; Gilmore, M.E.; Hart, S.C.; Traina, S.; Duttagupta, S.; Brooks, A.; Jerde, C.L.; et al. (2021) A Review of Environmental Pollution from the Use and Disposal of Cigarettes and Electronic Cigarettes: Contaminants, Sources, and Impacts. Sustainability 2021, 13, 12994. <https://doi.org/10.3390/su132312994>

We might add to this list, other forms of resource use and pollution that would accompany SU-ecig manufacture. These include:

- Water use
- Pollution of watercourses
- Pollutants contributing to worsening air quality
- Effect on habitat of primary materials extraction

The fact that SU-ecigs are not always discarded/managed in a responsible manner at end-of-life gives rise to additional issues of potential concern. Apart from the 'lost opportunity' associated with not recovering the materials contained in SU-ecigs, the fact that the full suite of chemicals in use might not always be well known is a cause of potential concern. SU-ecigs may contain brominated flame retardants, classed as persistent organic pollutants (POPs).

Some manufacturers may also be using organophosphate flame retardants, which are not classified as POPs. Various chemicals of concern may be used in manufacturing the plastic casings and components. The liquids used may also contain some chemicals which could be of concern when residual liquid remains in discarded e-cigarettes.

Data regarding the environmental impact of SU-ecigs are limited at present. In the detailed technical report, we have sought to derive what might be considered 'first estimates' of some of these impacts. We focused on those for which we were able to derive quantitative estimates easily. In doing so, we made assumptions regarding the average composition of an SU-ecig (based on lower unit weight SU-ecigs that appear to be market leaders) and drew on a range of secondary literature to derive the estimates. The detailed technical report includes full details of assumptions and sources.

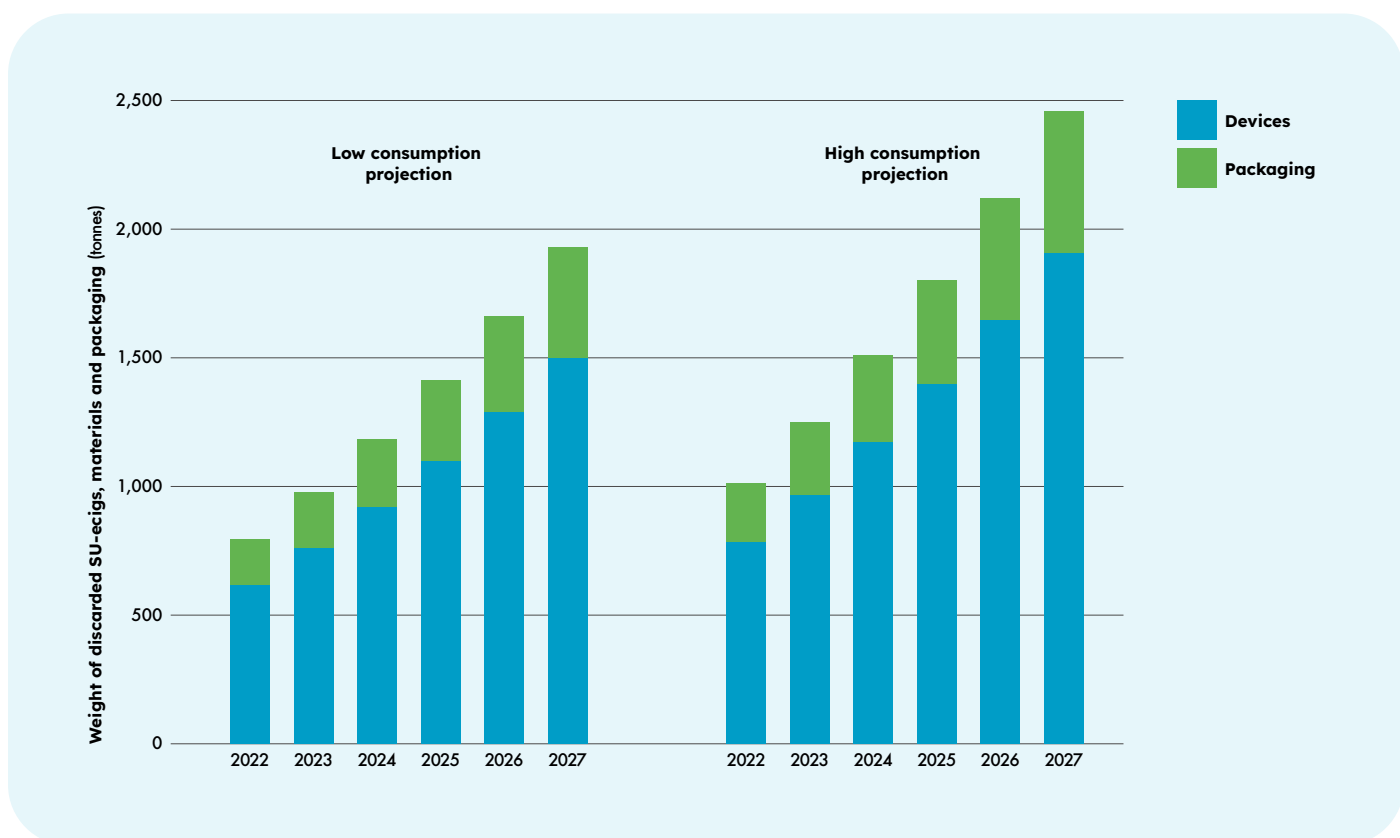


5.2 Quantities Discarded as Waste

Our estimate of the weight of packaging and materials which are discarded as a result of SU-ecig consumption in Scotland are shown in Figure E-4. The current quantity – estimated between 800 and 1,000 tonnes – is set to increase, in the absence of intervention, to around 1,900 to 2,500 tonnes by 2027, based on the assumptions above.



Figure E-4. Packaging and materials discarded from SU-ecig consumption in Scotland (tonnes)



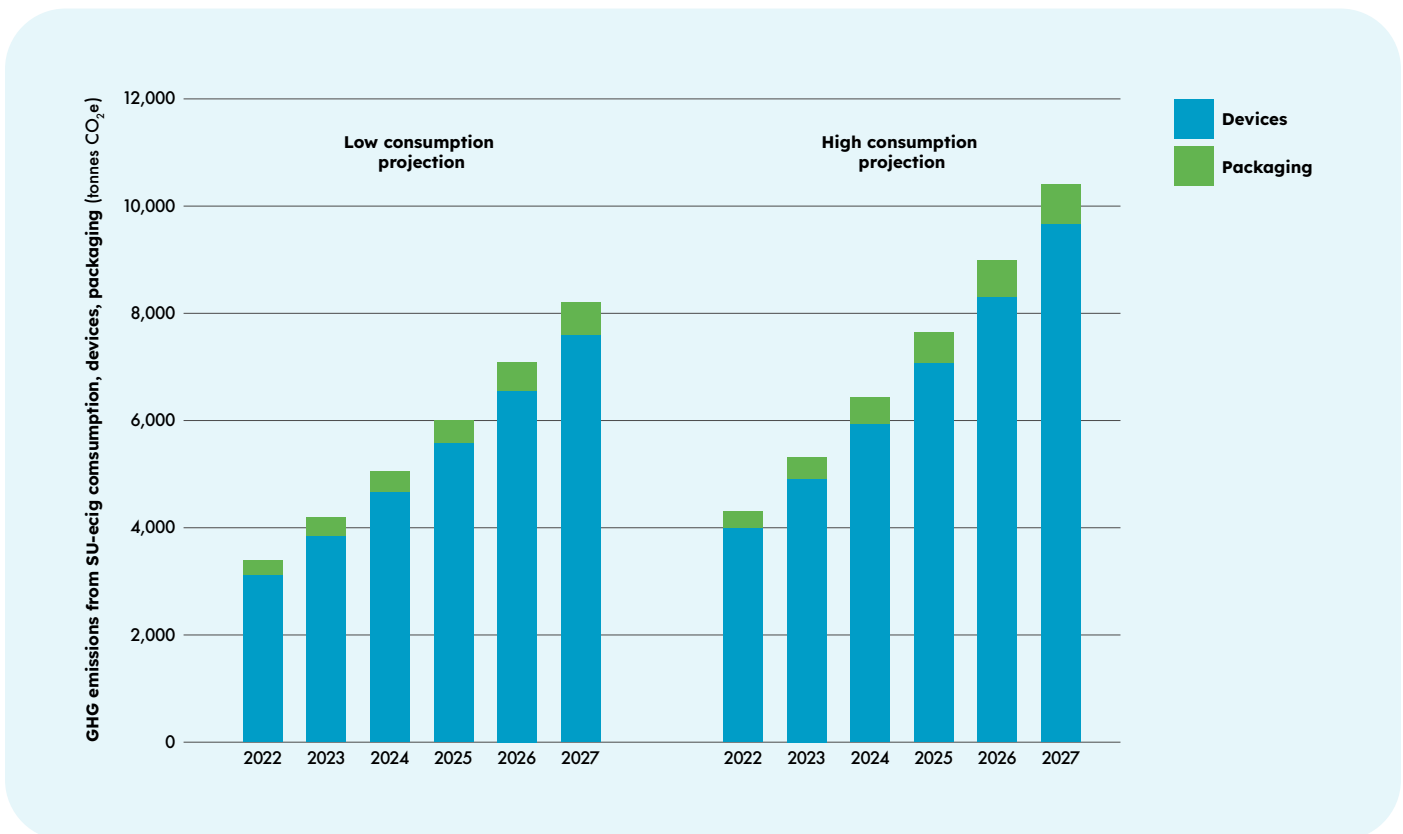
5.3 Greenhouse Gas Emissions Linked to SU-ecig Consumption

The greenhouse gas emissions ‘embodied’ in (i.e., emitted in making the materials within) the discarded packaging and devices associated with SU-ecig consumption are shown in Figure E-5. These do not include emissions linked to the vaped liquids (or the residues thereof in discarded SU-ecigs) or emissions associated with the manufacturing process itself.

We estimate that total emissions for SU-ecigs in Scotland are currently between 4000 tonnes CO₂e and 5000 tonnes CO₂e per year.

A 30g SU-ecig device gives rise to just over 150g CO₂e and the associated packaging accounts for a further 12g CO₂e or so. As regards the device itself, more than half the emissions are associated with the lithium-ion polymer batteries which are used in devices, and which account for about a third of the weight of materials in a discarded SU-ecig.

Figure E-5. GHG emissions linked to materials in packaging and devices linked to SU-ecig consumption in Scotland (tonnes CO₂e)



5.4 Water Consumption

We also estimated water consumption associated with the materials used in SU-ecig devices. Our estimate only includes water consumed in acquiring raw materials, and excludes materials processing and manufacture, whilst we have also omitted any consumption related to cotton use (which may be used in wicks). Our estimates of consumption are shown in Table E-1.

Because the production of SU-ecigs takes place mainly in China, and because the raw materials used are unlikely to have been sourced from Scotland, the impact of this water consumption is not experienced directly in Scotland.

5.5 End-of-Life and Littering

Data regarding the fate of SU-ecigs at end-of-life are not available. In the absence of explicit data, we based our estimate of the management of SU-ecigs on responses to a survey conducted by Opinium for Material Focus, and these are shown in Table E-2.

These two columns reflect low and high rates of littering as a percentage of estimated total sales. Based on an estimated total consumption range of between 20.6 and 26.3 million units, the amount of units littered in Scotland in 2022 could be between 721,000 and 2,787,800.

We derived estimates of the contribution of SU-ecigs to Scotland’s litter – by weight and by count – from the data on weight discarded (see above) and using the high and low littering rates in Table E-2. The value for all litter-related disamenity in Scotland (updated to 2022 values) was then pro-rated to the contribution made by SU-ecigs – by weight and by count – to Scotland’s litter problem (as it was in 2013).¹⁰ This gives estimates for the value of disamenity related to SU-ecig littering shown in Table E-3.

Table E-1. Estimated water consumption linked to materials used in SU-ecig devices consumed in Scotland (m³)

	2022	2023	2024	2025	2026	2027
Low Consumption	18,761	23,157	28,054	33,441	39,303	45,648
High Consumption	23,877	29,473	35,705	42,562	50,022	58,098

¹⁰ Eunomia (2013) Exploring the Indirect Costs of Litter in Scotland, Report to Zero Waste Scotland.

Table E-2. Patterns of Discarding of SU-ecigs

Method	% E-cigarette Discarded by Method (high % littered)	% E-cigarette Discarded by Method (low % littered)
Take-back to Store	12.8	13.8
Recycle them at a local authority recycling centre	8.3	9.0
Recycling bin	25.0	27.0
Residual Bin	43.3	46.7
Littering	10.6	3.5

Source: Estimates based on market research conducted by Opinium on behalf of Material Focus, June 2022 (unpublished).

Table E-3. Patterns of Discarding of SU-ecigs

		2026 (£ million)	2027 (£ million)
By Weight	Lowest	0.85	2.06
	Highest	3.12	7.59
By Count	Lowest	1.79	4.36
	Highest	6.61	16.09

Source: Estimates based on market research conducted by Opinium on behalf of Material Focus, June 2022 (unpublished).

Our estimate of the value of the disamenity associated with litter to the public are estimated to lie between £0.85 and £6.61 million, rising to between £2.06 and £16.09 million in 2027, depending on whether one apportions the disamenity by weight (lower end of range) or by count (higher end of range). These values are crudely estimated, and they take no account of the specific characteristics of different items and their possible contribution to disamenity).

Other impacts associated with littering may exist, but the evidence for these is limited. Most SU-ecigs are manufactured using an outer casing that is either wholly, or partially, plastic though some have cases that are primarily metallic. They also contain plastic within their body, as well as lithium-ion polymer batteries, and residual liquids (mainly glycerol and propylene glycol, but also including nicotine). These elements have potential to cause harm, including via ingestion by animals, but evidence as to the nature and extent of this impact is very limited at present.

The impacts associated with littering, the contribution of battery use to the GHG impact of SU-ecigs, and the GHGs embodied in the materials used would all be expected to be lower if fewer items are purchased, and purchased items are used for longer (by being refillable and/or rechargeable). Using devices that are not designed to be discarded once the first load of liquid contained therein has been utilised, would therefore likely lead to lower impacts.

5.6 Policies in Other Jurisdictions

Concerns around SU-ecigs are emerging worldwide. Several jurisdictions have introduced bans on sales, whilst some have banned only flavoured e-cigarettes. Several jurisdictions have introduced various forms of tax, but many of them base the tax on the amount of liquid consumed or levied on each rechargeable container/cartridge.

German policymakers are considering a ban on SU-ecigs. In the Republic of Ireland the current Public Health (Tobacco Products and Nicotine Inhaling Products) Bill will address smoking and vaping among those under 18 years and all adults. The New Zealand government announced on 6th June 2023 it would be banning most disposable vapes, not allowing new vape shops near schools and enforcing generic flavour descriptions.

At the EU level, clauses in the proposed Batteries Regulation, soon to be agreed, may lead to SU-ecigs being prevented from being placed on the market in the EU as of the end of 2026. Australia has recently issued a new strategy which intends to limit use of e-cigarettes to ones approved by Australia's Therapeutic Goods Administration, and which will only be available in pharmacies; flavoured e-cigarettes will no longer be available for purchase.

**CONCERNS AROUND
SU-ECIGS ARE
EMERGING WORLDWIDE.
SEVERAL JURISDICTIONS
HAVE INTRODUCED
POLICY RELATING
TO THE SALES
OF SU-ECIGS.**

5.7 Reserved/Devolved Legislation Interactions

In considering policy options, it is important to remember that environmental legislation is a mix of UK and Scottish legislation and though largely devolved, touches on certain reserved areas. In some areas a UK-wide, or four nation approach has been adopted through agreement.

This report focusses on a range of policy options that could have benefit in Scotland. Several options to tackle the issue of SU-ecigs may need to consider the interaction with the Internal Market Act. The nature of these are not considered in this report.



6 Initial Appraisal of Policy Options for Scotland

6.1 Policy Objectives

A range of policies were considered prior to shortlisting those which seemed most likely to meet the objectives set for policy in this study, namely:

- Improving management of single use e-cigarettes, and, enhancing the safe recycling of discarded products; and
- Reducing the disamenity and pollution impact of single use e-cigarettes.

6.2 Clarifying Eco-design Criteria in Existing Legislation

The environmental impacts identified above could be significantly reduced through either:

Option 1

Setting design criteria for e-cigarettes; and/or

Option 2

Requiring that batteries can not only be removed, but that they are also capable of being replaced (and we would add that the product should always outlive the battery). We consider this as a standalone policy even though it could also be considered as part of Option 1.

In considering these options, it might be useful to consider either or both of the following:

1. Addressing use of Rch-ecigs and the related pre-filled containers within the scope of the measure; and
2. Using complementary measures that would have the effect of reducing / eliminating the likelihood of some of the possible negative consequences arising (for example, by positively incentivising a shift to refillable e-cigarettes). That could be done with a suitably designed levy (see below).

In both the above cases, the Options are considered to have the effect of ruling products off the market where they fail to meet specific criteria. Because the design of SU-ecigs would likely fail a reasonable set of such criteria, so they would be excluded from the market.

6.3 A Ban on SU-ecigs

Option 3

A ban on the sale (both store retail and on-line) of SU-ecigs in Scotland could be explored. As mentioned earlier, a number of other jurisdictions have introduced or are considering bans on sales.

The four nations of the UK could jointly agree to ban SU-ecigs. Design and Implementation would need to consider that a possible consequence might be a switch to e-cigarettes that make use of replaceable pre-filled containers of liquids (Rch-ecigs). However, as these are already available at relatively low cost, the problem of wasted SU-ecigs might be supplanted by problems associated with Rch-ecig containers, including Rch-ecigs themselves being used as though they were SU-ecigs.

Scotland could, alternatively, instigate its own ban on SU-ecigs. Design and implementation would need to consider the potential for cross-border movement, and re-selling, with dissuasive sanctions set at a correspondingly high level to exercise the desired deterrent effect.

6.4 Other Policies

In considering the other policies, we assume that none of the options already discussed are not in effect, and summarise our appraisal of them in Table E-4: the following discussion refers to Options as numbered in the table.

Most of the measures are more likely to deliver on one or both objectives set out above.

Option 4

Charging a deposit for SU-ecigs to be refunded on return/recycling offers potential to deliver significantly against both objectives. One of the advantages of charging a deposit in this context is that if existing WEEE Regulations and associated take-back requirements were complied with, take-back systems would already be in place in a number of locations.¹¹ Enforcing the WEEE Regs, and making minor amendments, could ensure a suitably convenient return-to-retail option was in place. It might be that this could be complemented by 'smart-bin' approaches that allow for containers to be placed in other locations to support returns in 'on-the-go' situations.

¹¹ We note that some industry representatives are supportive of, for example, the initiative of Veolia (see Joshua Doherty (2023) Veolia launches nationwide vape recycling scheme, letsrecycle.com, April 24 2023, <https://www.letsrecycle.com/news/veolia-launches-nationwide-vape-recycling-scheme/>)

Option 5

A tax linked to recycling performance may offer the potential to deliver on both objectives, but (arguably) only if the route chosen by industry to deliver the higher recycling rate is a deposit for SU-ecigs to be refunded on return/recycling system, or similarly incentivised scheme to reduce littering. That likelihood increases where the incentive imparted by the tax is sufficiently large that industry opts to adopt an approach that delivers very high rates of performance.

Option 6

A comprehensive change in the obligations and categories within the current WEEE Regulations may deliver on both objectives, although its impact on littering rates is likely to be somewhat less than where a deposit incentivises returns, unless the targets that are set effectively makes incentivising returns (or returned deposit) the most efficient route to compliance. This Option extends the scope of cost recovery to include litter clean up (amongst other things), introduces a separate WEEE category for e-cigarettes, ensures that the costs of management of e-cigarettes are borne by the producers of them, and includes setting targets for separate collection and for recycling at high levels on e-cigarettes (of all types). Note that although this Option could include fee modulation in line with environmental characteristics, such as design for longevity, fee modulation as part of EPR tends to be constrained by the main cost recovery objective. It might be preferable to impart incentives through differential levies which can be set, and varied, without any constraints related to cost recovery.

Option 7

A levy or charge on sales payable by the consumer and designed to shift consumption away from SU-ecigs and more towards e-cigarettes where the user is expected to refill the device with liquid themselves (Rf-ecigs). We suggest that a levy could be structured so that there are differentials across the types of e-cigarettes, designed such that the highest levy falls on SU-ecigs with a lower levy applied to Rf- and Rch-ecigs, but with the pre-filled containers used in Rch-ecigs also subject to a levy to give clear preference to refillable forms. This may have the merit of increasing Scotland and UK manufacturing's share in 'vaping spend', given that most SU-ecigs are manufactured in China, but there is domestic production of liquids for use in vaping devices.

Option 8

The ban on flavoured e-cigarettes is one that has been deployed in many jurisdictions. We do not have exact figures on the proportion of SU-ecig sales which are flavoured (i.e., not tobacco, or not tobacco or menthol). We believe this share to be high, and most likely growing. The evidence, such as it exists, suggests that such bans can help reduce user numbers, and in particular younger user numbers, (relative to the counterfactual) over time, and potentially reduce the intensity of use in (some) remaining users. A ban on flavoured e-cigarettes just in Scotland however is potentially problematic. There are likely to be attempts to get round such a ban through purchases from England (and re-sale), whilst some outlets might simply not comply (illegal sales). Again, dissuasive sanctions of a suitable magnitude would be useful to support an enforcement effort.

Option 9

Tightening of enforcement of existing law in relation to underage sales is a measure which could be considered as a matter of urgency given that under age users are the main users of SU-ecigs. Depending on the approach taken,

the effect could be to reduce (over time) the extent to which underage users continue to use e-cigarettes, and to reduce the number of new underage users of e-cigarettes.

Finally, it is worth considering how the above Options might be used as part of a package of complementary measures. Combining Option 6, which is strong on infrastructure and managing end-of-life materials, with Option 7 that incentivises shifts away from the main source of littering of SU-ecigs, would have increased impact. Similarly, combining Option 6 with Option 4, or implementing Option 4 as part of Option 6 (in the context of an extended requirement for take-back of e-cigarettes by those selling them).

Other combinations are indicated in the final column of the following table. Option 6 could, in our view, flow naturally from a sensible revision to the WEEE Regulations, so creative combinations of Options along with Option 6 could be of considerable interest. That having been said, the likely pace of delivery of Option 6 is reason enough to keep other Options in play.

It should be noted that Option 6 is likely to be key to the proper management of e-cigarettes. For this reason, consideration could be given to implementing Option 6 as a standalone policy (extended producer responsibility for e-cigarettes) in Scotland.

Further, more detailed, consideration and analysis are merited in advance of making a clear decision. There is an ongoing four-nation review of current WEEE regulations which may be relevant to consideration of policy options, and, given the high degree of public concern regarding single-use vapes, other nations of the UK will likely also be considering potential options in this area.

It is worth reflecting that Options for addressing the impact of SU-ecigs tend to work either on sales/demand, or on the way SU-ecigs are managed. Both the resource use and littering are likely to be impacted by demand side changes. Where the issues are being addressed through improved management of SU-ecigs (as opposed to measures working on the demand side), the approach needs to consider behaviour, especially in respect of littering, as well as the provision of convenient and properly funded infrastructure. The performance outcomes which could be targeted – in terms of separate collection and recycling – would benefit from being set at sufficiently ambitious levels as to ensure that littering is addressed, either explicitly, or implicitly, by the measure, or measures being designed.

Table E-4. Summary appraisal of options

Policy Option	Measure	Environmental Impact		Costs	Complementary Measures
		Management of Discarded Items	Litter		
1 2 3	Setting minimum eco-design criteria for e-cigarettes;	Likely to reduce quantities. No effect on remaining e-cigarettes used.	Likely to reduce quantities. No effect on remaining e-cigarettes used, though these may be littered less frequently. Possible issue with increase in use of Rch-ecigs (and the pre-filled containers) if they are not banned also.	Not costly to introduce. Enforcement will require resourcing (especially for a Scotland-specific ban owing to potential for cross-border imports/black market sales). Main costs will be to manufacturing the vast majority of which is in China. Shift to Rch/Rf-ecigs, maybe to local liquid manufacturers.	Make use of other instruments, such as levies, to reduce extent to which the default alternative is low cost Rch-ecigs.
	Imposing a requirement for batteries to be replaceable for all WEEE.				
	Ban via new legislation, in Scotland or UK-wide.				
4	Charging a deposit for SU-ecigs to be refunded on return/recycling	Could allow for increased rate of return of SU (and other) e-cigarettes to suitable return locations.	With sufficient deposit, could generate reduced littering (and increased activity in litter pick up). Does not necessarily drive change in consumption patterns (may simply ensure that what is consumed is returned for proper management).	Costs depend on baseline availability of take-back. If there is full compliance with take-back obligation, then there may already be a basis for building the necessary infrastructure.	Govt could set minimum return and recycling rates for system. Could be implemented alongside/as part of Option 6.
5	Levy linked to recycling rates.	Could enhance recycling as long as the incentive effect is strong enough.	May reduce litter if the main mechanism used to increase recycling rates is similar to a charged deposit system.	Would generate revenue as recycling rates build up. Industry would be expected to organise response.	Could be set separately for SU-ecigs and 'other'-e-cigarettes. If so (if data allowed) would enable a different levy profile, and so may also drive consumption away from SU-ecigs. Might be linked to Option 6 below.

Table E-4. Summary appraisal of options cont'd.

Policy Option	Measure	Environmental Impact		Costs	Complementary Measures
		Management of Discarded Items	Litter		
6	<p>WEEE Regulations reformed such that there is:</p> <ol style="list-style-type: none"> 1. a separate Category of WEEE for e-cigarettes, along with; 2. full cost recovery from producers (residual, public bins, litter clean up) and comms regarding effects of littering / alternatives to SU-ecigs; 3. category specific collection target; and 4. category specific recycling target. 	<p>Management of what is collected could improve considerably. Does not necessarily drive change in consumption patterns (may simply ensure that what is consumed is returned for proper management).</p>	<p>Littering behaviour could decline, but likely not to levels as low as with a deposit on return (consumers have no incentive to return).</p>	<p>Costs to e-cigarettes producers will increase significantly to accurately reflect costs of managing their products at end of life. PCSs will have a basis for investment. Some incentive for better design.</p>	<p>Could be coupled to an incentive mechanism such as Option 7 or Option 4.</p>
7	<p>Levy on e-cigarettes designed to shift consumption 'up the ecig hierarchy':</p> <ol style="list-style-type: none"> 1. a levy on SU-ecigs at £X per device; 2. a levy on Rf-ecigs/Rch-ecigs at a lower level, £Y per device; and: 3. a levy on all pre-filled rechargeable containers at £Z per container <p>(or as above but with additional levy for nicotine in liquids).</p>	<p>No guarantee of significantly enhanced management of e-cigarettes which are consumed.</p>	<p>At suitable levels, could reduce SU-ecigs considerably and hence address main source of litter problem. Structure also seeks to address Rch-ecig containers.</p>	<p>Could generate revenue. If well designed, manufacturers of SU-ecigs will see market reduced. May lead to increased share of spend moving to refillable liquids (some of which maybe Scotland/ UK based).</p>	<p>Could be coupled to a mechanism designed to enhance management such as Option 6.</p>

Table E-4. Summary appraisal of options cont'd.

Policy Option	Measure	Environmental Impact		Costs	Complementary Measures
		Management of Discarded Items	Litter		
8	Ban on flavoured e-cigarettes.	No effect on remaining e-cigarettes used, though these may be littered less frequently. Possible issue with an increase in use of Rch-ecigs (and the pre-filled containers) if they are not included in the scope of the ban.	Likely to reduce quantities. If the flavoured SU-ecigs account for a majority of the market, then a ban on flavoured e-cigarettes could reduce demand through affecting user numbers, and intensity of use. It could also reduce (the rate of increase in) uptake.	Not costly to introduce. Enforcement will require resourcing (especially for Scotland-specific ban owing to potential for cross-border imports/re-selling). Main costs will be to manufacturing, the vast majority of which is in China. Shift to Rch/Rf-ecigs, maybe to local liquid manufacturers.	Could be used in conjunction with Option 5 or 7. Implementing Option 6 would also help ensure proper management of remaining e-cigarettes.
9	Enhanced enforcement of age restriction on sales of e-cigarettes.	Has no impact on those e-cigarettes still being consumed.	Would impact demand for e-cigarettes, and may impact on future projections of users. Could have some impact through demand effect.	Additional enforcement costs. Costs could be 'offset' somewhat by higher penalties for breaking the law. Enforcement cost could be recovered from producers (including under enhanced WEEE Regulations).	Given that this measure seeks to address failures in enforcing existing law, it could be part of the overall package of measures considered.

