

Report

Spring 2015



Recycle and Reward Pilot Project Report North Ayrshire Schools



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Zero Waste Scotland works with businesses, individuals, communities and local authorities to help them reduce waste, recycle more and use resources sustainably.

Find out more at zerowastescotland.org.uk

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1 Executive summary

Zero Waste Scotland supported a number of Recycle and Reward pilot projects in 2013. Each site has a separate report on its performance, and an overview report is also available.

North Ayrshire Council (NAC) participated in the Recycle and Reward pilot project, funded by Zero Waste Scotland, to gain a better understanding of how incentivised recycling facilities may affect recycling behaviour for drinks containers within three secondary schools. The three schools of Ardrossan Academy, Garnock Academy and Largs Academy each installed one C1500 Recycle and Reward machine, provided by Revendit, in their canteen facility. These automated machines provided a reward (a money-off voucher to be spent in the canteen) in exchange for empty drinks containers returned for recycling through the machine. The target materials for this pilot project were aluminium cans and clear polyethylene terephthalate (PET) plastic bottles.

The formal pilot covered 14 weeks in which the schools were open – the weeks ending 10 May to 28 June 2013, and 23 August to 27 September 2013 – with the summer holiday (when the premises are not in use) in between. The start date varied across sites: 9 May in Ardrossan and Garnock, and 25 May in Largs.

In terms of the overall performance of the pilot:

- User surveying suggests that 37% of the survey respondents had used the Recycle and Reward machines, and 22% had used the machines at least once a week.
 - The machines collected 5,022 containers, made up of 4,425 PET bottles and 597 cans. Cans are not sold within the schools, so all cans were purchased off site.
 - Across all schools, this figure represents 39% of the containers estimated to have been sold on campus during the period (capture rate by sales at the school outlets). If the weeks when the machines required maintenance are excluded, the capture rate is ~46%.
 - The schools do not sell cans. If the capture rate compares sales with only PET recycled, the capture rate is 30% overall, and 40% for the weeks when the machines were available.
 - Performance varied between sites, and the capture rate also fluctuated significantly between weeks. There is some evidence that many containers were brought on site from home or local shops. Some of these will have been for consumption on the premises anyway, but some may have been brought on site purely to claim a reward, potentially displacing some recycling elsewhere – though the low reward redemption rate suggests this factor may not have been a big driver.
 - Only 23% of the reward vouchers that were issued were redeemed.
 - The absolute quantities collected by the scheme were 0.1t, ~3% of the aluminium can and PET bottle waste on site over 14 weeks and ~0.1% of the estimated total waste on site (including paper, food and general waste). The tonnage of targeted recycling is likely to be a smaller proportion of overall waste, given the relatively low volumes and unit weights of target containers compared with paper and general waste including food.
 - Of those surveyed, 35% claimed to be recycling more as a result of the scheme. This is higher than in other pilots, and may be partly accounted for by the fact that recycling opportunities were limited before the pilot.
 - Overall, 38% of those surveyed wanted to see the scheme continue and only 7% did not; 56% were unsure.
 - Subsequent monitoring by Zero Waste Scotland showed that overall scheme performance (in terms of containers returned) was maintained, but that divergence between the schools was significant – just one location accounted for the vast majority of recycling in the autumn term. This conclusion is particularly interesting, as the scheme design and – at first glance – operational context across all sites were similar. Contextual factors (particularly in the new academic year) are the only way to account for this divergence, and in truth these are poorly understood.
 - As of April 2015, two sites were still operating, and one had been discontinued.
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Overall, it seems fair to say that the scheme did encourage recycling, but it is less clear that this was driven by the incentivised element of the scheme. Alternative recycling options were limited, meaning the machines were likely to be used by anyone wanting to recycle, while the redemption rate for rewards was low, suggesting this was not a significant behavioural driver.

2 Pilot description

This section describes the sites for the North Ayrshire schools pilot, and the population targeted by the pilot. It then considers waste management systems in place before and during the pilot period, and then the detail of the Recycle and Reward scheme put in place, including sections on the communications and site resourcing requirements of the pilot. A final section describes any changes to the above introduced during the pilot period.

2.1 Background and context

North Ayrshire schools participated in the Recycle and Reward pilot project, funded by Zero Waste Scotland, and introduced Recycle and Reward machines to three schools. Each school is a secondary comprehensive, and is pictured in Figure 1. The public is able to use some of each school's facilities (mainly sports) out of school hours, though they are not permitted to enter the school canteens, so they could not have used the Recycle and Reward facilities.



Figure 1 Ardrossan, Garnock and Largs academies

For the 2012/13 academic year, data from Education Scotland show that Ardrossan Academy had a school roll of 854 pupils and 67 full-time equivalent (FTE) staff, Garnock Academy had a school roll of 1,020 pupils and 82.4 FTE staff, and Largs Academy had a school roll of 1,080 pupils and 81.6 FTE staff.

In each school the machines were located in the canteens. This location was chosen because of the high footfall of pupils passing the area on a daily basis. In Largs Academy, where there are separate senior and junior canteens, the machine was located in the junior canteen.

The system boundaries are considered to be the campus for each of the three schools. They are relatively 'closed' systems used by school pupils, staff and service providers, although school users are able to bring cans and PET bottles from home, and these are accepted by the scheme.

2.2 Waste management arrangements before the pilot

The waste management arrangements before the pilot involved the provision of the following:

- Ardrossan Academy – four 1,100-litre general waste bins collected three times a week and two 1,280-litre paper recycling bins collected once a week;
- Garnock Academy – eleven 1,100-litre general waste bins collected twice a week, two 1,100-litre paper recycling bins collected twice a week and two 1,100-litre bins for recycling flattened cardboard collected twice a week; and
- Largs Academy – four 1,100-litre general waste bins collected twice a week and three 1,100-litre paper recycling bins collected twice a week.

At each school, fixed external litter bins are provided in outside areas such as playgrounds. Waste collected from these bins is disposed of into the general waste bins.

Before the pilot there was no separate collection of aluminium cans or plastic bottles and these materials were part of the residual waste stream. Classrooms and administrative areas were provided with recycling bins for paper wastes. At each school the janitors undertook daily litter picks and disposed of the waste into the general waste stream.

Figure 2 sets out the waste management material flow and system boundary before the pilot was implemented.

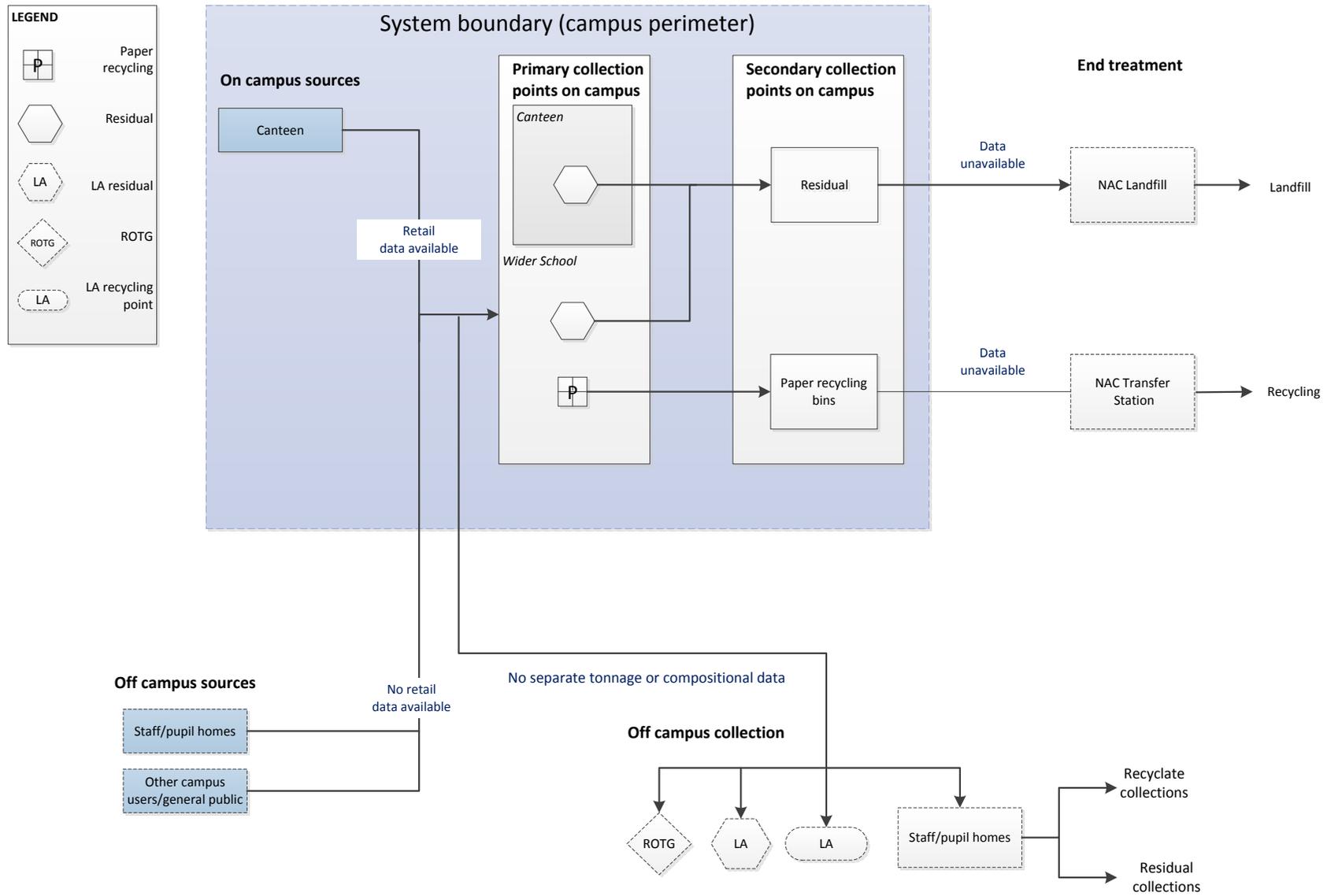


Figure 2 Flow of waste and waste data before reverse vending pilot implementation

2.3 Target population

The population for each school is as displayed in Table 1.

School	Student population	Staff population	Total
Ardrossan Academy	854	67	921
Garnock Academy	1,020	82	1,102
Largs Academy	1,080	82	1,162
Total	2,954	231	3,185

Table 1 Demographics of the NAC schools

While members of the public can access parts of the school for other purposes (e.g. to use the five-a-side pitches), they do not have access to the canteen, and are thus unlikely to have contributed to the tonnages collected through the Recycle and Reward machines, although they may slightly affect overall waste, including target materials, on the site. Overall, this is not considered to be a significant effect.

It is, however, possible for students to bring containers from off site, and these were accepted by the scheme. Thus, potentially at least, more containers may be available to the scheme than just those purchased on site.

2.4 Recycle and Reward approach

There were a variety of retail outlets within the schools in which pupils could buy drinks containers, including the canteens and vending machines; however, aluminium cans were not sold in any of the schools.

The launch date for the pilot in Ardrossan Academy and Garnock Academy was the 9 May 2013; in Largs Academy it was the 25 May 2013.

Pupils were also allowed to bring in materials from outside the school to recycle in the machines, so it can be deduced that any aluminium cans collected during the project would have originated from outside the pilot boundary. This may also be true of some plastic bottles collected.

Figure 3 shows a picture of the C1500 machine used in all the schools. The Recycle and Reward machines had a combination of on-screen instructions and additional graphical instructions to inform users how to recycle drinks containers using the machine. Once the container was inserted into the container aperture, the machine used shape recognition technology to identify whether it was a bottle or a can and then sorted the item into one of two collection sacks: one for clear PET plastic and one for aluminium. Any non-target materials, such as steel cans and coloured PET plastic bottles, were returned to the user through the reject chute.



Figure 3 The C1500 Recycle and Reward machine

To collect the reward voucher the user needed to press the green button on the front of the machine once all containers had been recycled.

All machines were fitted with compactors, which allowed greater material storage capacity and reduced the need for regular emptying in high-use environments.

In all schools the reward for recycling each bottle or can was a voucher for 5p, which could be redeemed as a discount on healthy meal options served in the school canteen, with a maximum of 50p to be spent in one transaction.

Figure 4 depicts the waste management material flow and system boundary during the pilot.

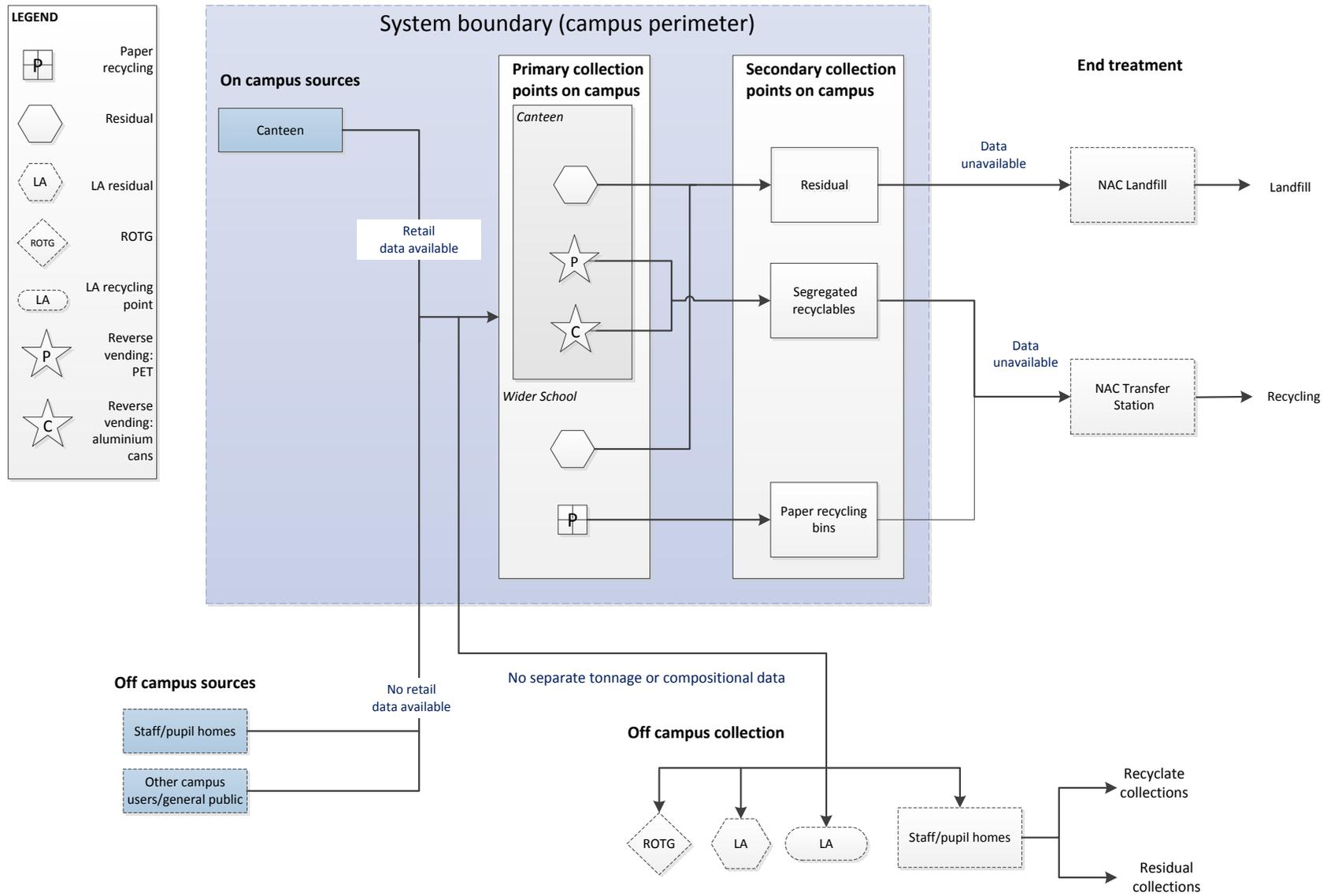


Figure 4 Flow of waste and waste data after Recycle and Reward pilot project implementation

2.5 Promoting the scheme

Zero Waste Scotland provided communications support and resources to help NAC develop a communications plan and timetable of activities for the North Ayrshire schools pilot project. The plan was approved by Zero Waste Scotland, as were all graphics, materials and supporting text.

The target audiences of the communications plan were:

- school pupils;
- teachers and other school staff; and
- the general public

2.5.1 *In-school promotion*

NAC worked with the schools involved to ensure they promoted the machines using their own communications channels, including their websites and intranets and any magazines or newsletters they produce. This is the route most directly targeted at potential scheme users.

The following communications were undertaken:

2.5.1.1 **Largs Academy**

- Announcement at registration classes
- School magazine
- Zero Waste Scotland Posters

2.5.1.2 **Ardrossan Academy**

- Announcement at registration classes
- Year group newsletter
- Term newsletter
- Eco Council
- Fair Trade Council
- Pupil Council
- Plan Eat event
- Zero Waste Scotland posters

2.5.1.3 **Garnock Academy**

- Announcement at registration classes
- Personal and Social Education curriculum (S1–S4)
- Prefect group
- Year group councils
- Website
- Glow (online community for Scottish schools)
- Intranet
- Email
- Daily bulletin
- Zero Waste Scotland posters

2.5.1.4 **Assembly talk**

A waste awareness officer gave a talk on the advantages of using Recycle and Reward Machines in all three schools. The talk included a demonstration of how to use the machines and a quiz on facts about recycling.

2.5.1.5 Posters/information points

Posters were displayed around the school buildings directing pupils, staff and visitors to the machines. Signage for Recycle and Reward was clearly visible at each machine site. Following several weeks of operation, it was necessary to develop additional information at each machine to instruct pupils and staff to recycle neither coloured PET plastic bottles nor steel cans, as these were rejected by the machine. These materials, if inserted into the machine, could potentially jam the opening mechanism, until the item was removed by janitorial staff.

2.5.1.6 Roadshows

Roadshows took place at each of the three schools in the week before the launch of the project.

2.5.1.7 Stakeholder engagement/training

Training by the equipment supplier was provided to key staff at all schools on 9 May 2013, during the week of equipment installation. This included janitors at all three secondary schools, who are responsible for emptying the machines and also changing the voucher roll. Janitors are also responsible for correcting any minor damage, and in the event of serious damage they were instructed to contact a service engineer as part of the 12-month maintenance warranty. Waste awareness officers also received training, as they are responsible for monitoring the performance of the project in terms of tonnage, fill levels and quality of recyclables from the machines.

2.5.2 Wider promotion and marketing

2.5.2.1 Website/social media

Press releases were added to the news section of the NAC website, and Twitter was used to widen the reach of the information.

2.6 Changes during the pilot period

The operation of this pilot saw a varied range of promotional activity over the pilot period. The pilot project also saw a break for the schools summer holiday, after which a new student population needed to be instructed in the scheme. Both of these may have affected pilot performance, in terms of the user experience and the number of containers collected. The machine at Ardrossan was also out of commission, as a result of vandalism, for the first four weeks of the new academic year.

At the North Ayrshire schools further signage was added to the front of the machine during the pilot to inform the users that the machine did not accept coloured drinks bottles. This can be seen in Figure 3.

3 Study method

The appendix gives greater detail on the method selected and the reasons for this. This section focuses on how these were applied in this specific location, first describing the approach to data collection on performance, and then the approach taken to the social research (obtaining user, non-user and staff feedback at the site). A final section considers challenges encountered in practice, and the extent to which this affects the conclusions that can be drawn about pilot performance.

3.1 Performance data collection

3.1.1 *Machine throughput*

Data on quantities of cans and PET bottles were obtained on a weekly basis from the digital counter located on each Recycle and Reward machine. The janitors in each school facilitated this process during the pilot.

The school janitors provided the weekly machine (container returns) data from a manual reading on the Recycle and Reward machines. The manual nature of the reading may have introduced some small error, as the timings of readings in the day may not have been consistent. However, this is unlikely to have affected the monthly analysis, and certainly not the final figures.

Downtime was also logged as a textual weekly report, with the only significant issue being at Ardrossan where the machine was out of commission for the first four weeks of the autumn term up to and including the week commencing 13 September.

3.1.2 *Waste and recycling data*

The schools did not weigh waste before the pilot period, so baseline 2012 data were not available for the equivalent period. The quantity of waste generated in a typical year for residual waste (including target recyclables) at each school was therefore estimated using data provided by the waste contractor for bin numbers, bin volume and fill and frequency of collection. WRAP bulk density factors were then used to estimate weights. During the pilot it was not practical to weigh non-machine waste with the resources available. It was acknowledged that this was a data limitation, and waste compositional analysis was undertaken (see below) to partly offset this.

Equally, as there was no on site recycling provision before the pilot, any material collected by the machines was additional – and, given the relatively light item weights, diversion from residual waste would be very hard to discern even with very detailed baseline weight data.

A one-off walk around considered the levels of litter present within the site boundaries of each school before the pilot commenced. It was noted that there were a number of cans and plastic bottles in the school grounds that could be accepted by the machines once they were installed.

3.1.3 *Retail and rewards data*

The sales data provided a context for the number of bottles and cans collected and enabled calculations to be made about the return rate of target materials. As noted earlier, this is complicated by the fact that materials can be brought onto the site from outside and recycled. None of the schools sold aluminium cans; hence, any aluminium cans placed in the machines were therefore imported from outside the school boundary.

Sales data for the pilot and the corresponding period in 2012 were also obtained to ascertain whether the presence of the Recycle and Reward machines encouraged additional sales of beverages in target containers. Monthly sales data were provided by North Ayrshire Council's catering staff. Sales data are expressed as the number of units sold, as opposed to financial value.

Sales data for the in-pilot and baseline (pre-pilot) periods were received following the conclusion of the pilot reporting period on 27 September. North Ayrshire Council's catering reporting system accrues sales data on a monthly rather than weekly basis. The sales data have therefore been analysed monthly so that capture rates and overall pilot capture rates are accurate. Weekly apportionment of these figures would have distorted the results. While this has implications for the granularity of the analysis, it has no implications for the overall accuracy of the data.

Details of voucher redemptions were obtained to understand the proportion of machine vouchers issued that were redeemed at the canteens. Monthly data of voucher redemptions per school was provided by North Ayrshire Council's catering staff. Voucher redemption data are expressed as the number of vouchers redeemed, rather than the financial value.

Voucher data were also provided following the conclusion of the pilot reporting period on 27 September and based on monthly data. Consequently, return and redemption rates have been analysed monthly. Weekly apportionment of these figures would have distorted the results. Again, this has no implications for the overall accuracy of the data.

3.1.4 *Waste composition analysis.*

To compensate for a lack of available waste weight data and the difficulties involved in estimating these, a waste composition analysis for each school was undertaken before and during the pilots. The objective was to identify impacts of the pilot upon the profile of wastes and the presence of target materials in the general waste streams.

The first analysis was carried out on 28 March 2013 and a further, identical, in-pilot analysis was undertaken on 19 September. Samples were taken over the course of a day from general waste bins in the canteen areas at each school. A one-day sample of the litter picked by janitors was also analysed. Waste samples were collected from each school and taken to Garnock Academy for sorting. Waste was hand sorted into 10 targeted categories: paper, card, cardboard, mixed glass, aluminium cans, steel cans, PET bottles, other plastics, plastic film and food. All other waste was classed as 'Other'. Separately collected paper and card for recycling was not included in the waste compositional analysis.

Despite the compositional analysis, the limited availability of weight data for the site significantly constrains what can be concluded about overall waste flows on site. Some initial manual inspection of the fullness of bins was undertaken during the pilot, but it was not possible to accurately determine the average fullness of bins as the use of bins varied from week to week and they were uplifted at different times on their appointed collection days. Inaccuracy in this process was too great to ascertain changes in specific material streams. The baseline estimate for the 2012 waste, however, allows the scale of the Recycle and Reward collection to be put in context.

3.1.5 *Machine downtime data*

Each week janitors provided a simple text-based summary of the operational availability of the machines.

3.2 Social research – quantitative survey and observations

The methodologies used to appraise pupil and staff attitudes, behaviour and experience of using the Recycle and Reward scheme at the three schools were:

- observational analysis (one day, Garnock Academy, 26 June 2013); and
- quantitative online surveys (online from 18 to 28 June 2013).

Because the survey was targeted at pupils and online, the questions were simpler than in other pilot schemes and the survey was shorter.

In addition, since the machine is located in the junior canteen at Largs Academy, only responses from S1–S3 pupils were received in this case, as they were the audience most directly targeted by the machine.

3.2.1 *Observational analysis*

Observational analysis was carried out by a trained NSA engagement officer in Garnock Academy on 26 June 2013 between 09:45 and 14:00. This covered the times when the canteen was open to pupils for morning interval between 11:00 and 11:15 and for lunch between 13:00 and 13:40. Unfortunately, machine use during the day of observation was very low, with just four transactions observed. One user was an individual pupil, two users were pupils in a group of three and one user was a teacher. These data therefore cannot be subjected to quantitative analysis.

This low level of use was not necessarily particularly atypical for this site, given the data on the number of containers received (averaging 14 containers per school day at Garnock, though this is still somewhat higher than was actually seen during observation). With hindsight, it seems likely that significantly more data would have been collected at Largs (averaging 47 containers per school day, and accounting for a lot more of the scheme returns).

3.2.2 *Quantitative survey*

The online survey was designed to collect the views of a sample of pupils. An online methodology was chosen both for resource reasons and because the school environment meant this was a good channel to reach students.

The survey was live between 18 and 28 June 2013. The survey was carried out by pupils selected by key staff contacts within each school. Staff were asked to select a sample of 50 pupils from each school, including both male and female participants across all year groups and abilities, to allow a representative sample to be gathered. As noted above, however, only years S1–S3 were surveyed at Largs Academy owing to the location of the Recycle and Reward machine in the junior canteen.

The survey sample, though relatively small, was intended to be representative of the student body. However, it did not represent a randomly selected sample, and some bias cannot be ruled out as a result.

The overall survey exceeded the target of 150 but was less well completed at Largs. Largs responses represent under a third of the total (20% of all responses) whereas Ardrossan contributed 43% and Garnock 37%. The gender split of the actual populations is not known, but can be assumed to be reasonably balanced. There was a 54:46 male to female split in the survey responses. The profile is detailed in Table 2.

Year group	Ardrossan Academy		Garnock Academy		Largs Academy		Total		Total
	Male	Female	Male	Female	Male	Female	Male	Female	
S1	0	1	11	8	5	5	16	14	30
S2	8	9	15	14	9	4	32	27	59
S3	11	15	1	0	6	5	18	20	38
S4	0	0	0	3	3	0	3	3	6
S5	17	12	7	3	0	0	24	15	39
S6	3	3	4	2	0	0	7	5	12
Total	39	40	38	30	23	14	100	84	184

Table 2 Age and gender profile of survey participants

4 Pilot performance and operation

The following sections contain detailed quantitative and qualitative analyses of the schemes performance. Sections 4.1 and 4.2 compare the machine data with the reported recycling behaviours from the social research, which are broadly complementary. Section 4.3 considers the rewards issued and claimed in more detail, while section 4.4 focuses on the users' familiarity with the machines and how often they use them. Finally, sections 4.5 to 4.9 explore the potential wider implications of the pilot. This includes consideration of possible impacts on litter, net waste on site, any boost to sales on site and improvements in recycle quality. Finally we consider operational aspects of the pilot, focusing on machine reliability (both actual and perceived) and staffing implications.

4.1 Overview

Table 3 presents the overall count of units recycled for the pilot, per school and in total. Table 4 provides performance of each school and the pilot in total in terms of the capture rate (returns to the machines as a percentage of relevant beverage sales on site), redemption rate (percentage of vouchers redeemed) and redemptions as a percentage of relevant beverage sales. Figures 5 and 6 provide results over the duration of the pilot period.

School	Sales	Total containers collected (= vouchers issued)	Aluminium cans collected	PET bottles collected	Vouchers redeemed
Ardrossan Academy	3,982	772	60	712	137
Garnock Academy	483	947	110	837	348
Largs Academy	8,464	3,303	427	2,876	703
Total	12,929	5,022	597	4,425	1,188

Table 3 Overall unit counts per school and total

School	Capture rate (% collected of those sold on site)	Redemption rate (% of vouchers redeemed)	Redemptions as % of sales
Ardrossan Academy	19.4	17.7	3.4
Garnock Academy	196.1	36.7	72.0
Largs Academy	39.0	21.3	8.3
Total	38.8	23.7	9.2

Table 4 Overall performance results per school and total

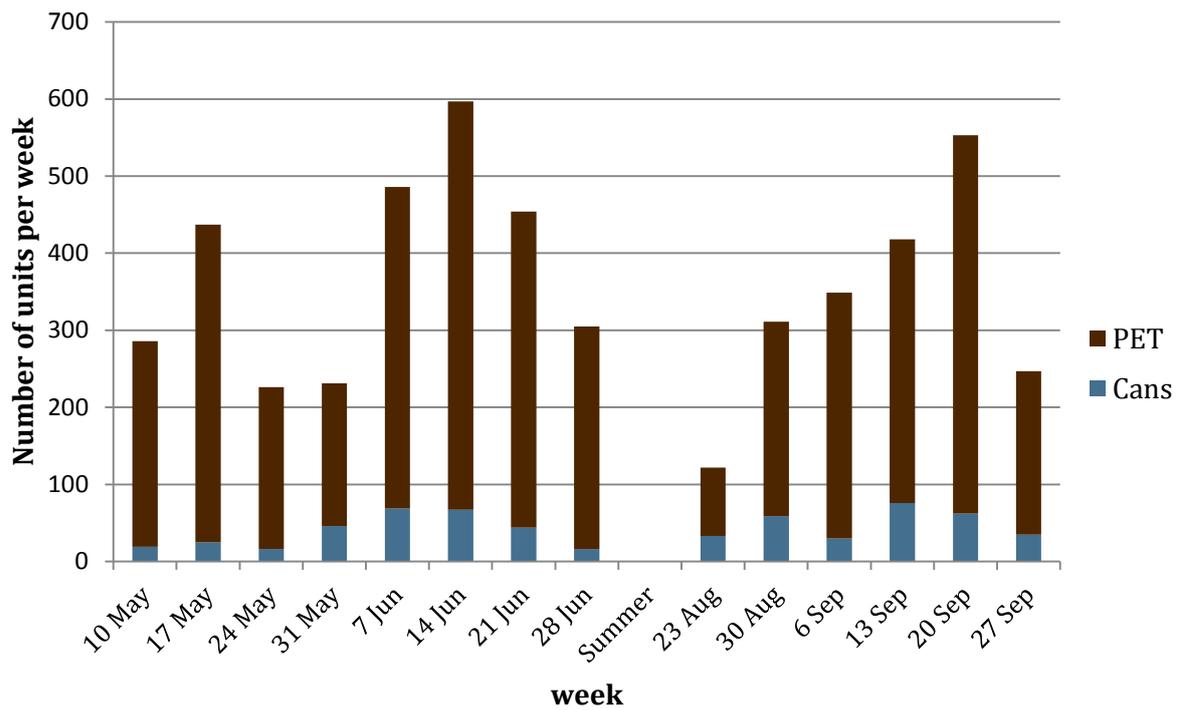


Figure 5 Overall North Ayrshire schools number of units recycled by material type

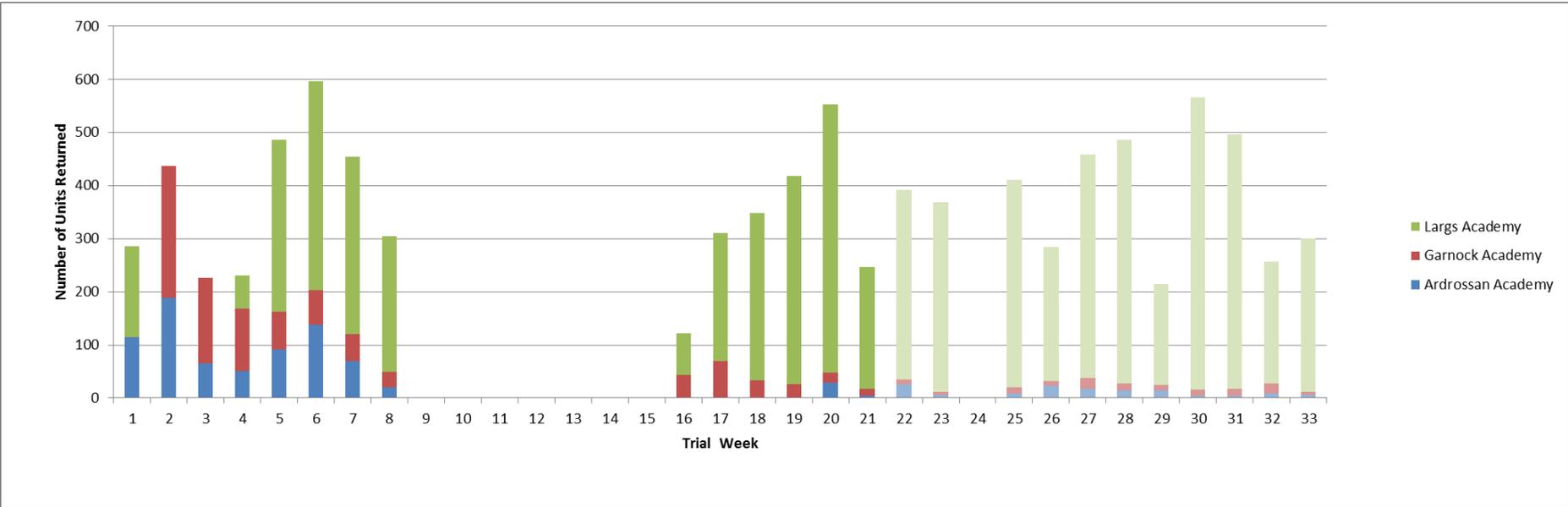


Figure 6 Overall North Ayrshire schools number of units recycled by school, including the entire autumn term

The data suggests that, on average, Ardrossan and Garnock were recycling 15 containers per day, but that Largs recycled 55 containers per day. The population and user survey results suggest that Ardrossan and Largs had an average of five users per day, and Garnock an average of eight, though the samples on which this is based have some limitations. This would suggest that the amount of recycling that each user did at Largs was higher than at the other schools. There is no particular difference between the schools to explain this, and it is unclear whether this is a surveying anomaly or genuinely different user behaviour.

The data for Garnock affect the overall results significantly. Far more is recycled through the machines than is sold in the shop, as shown by the high capture rate (196%), and this is totally different from the other sites. The sales from Garnock are much lower (thus impacting the capture rate) and, while the reason is unclear, this implies that containers must originate at home and in local shops. This is supported by the online survey undertaken as part of the social research, which asked the students where the bottles and cans they recycled had come from. As detailed in Figure 7, this showed that users recycle containers from nearby shops and home as well as school retail outlets. Users at all schools are likely to be bringing individual cans and bottles from home or other sources to consume on site and then recycle through the machine, so there is no real evidence of diversion of recycle from elsewhere (a conclusion strengthened by the relatively low redemption rate for rewards).

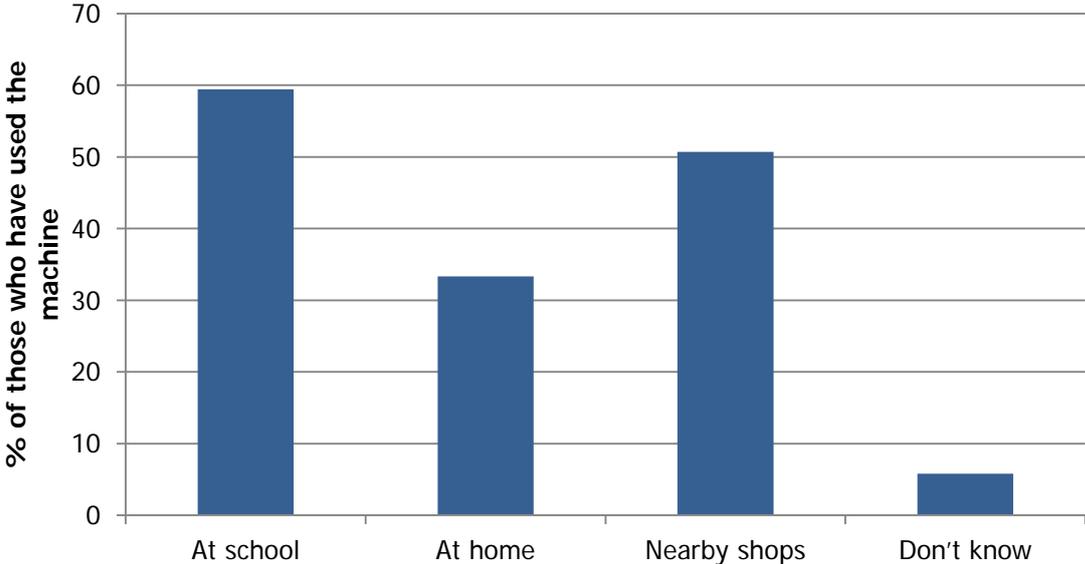


Figure 7 Sources of the bottles and cans recycled using the machines

The number of units collected per week across the three schools by material type is shown in Figure 5. The overall units per week broken down by school are shown in Figure 6, which includes data collected over the entirety of the autumn term by Zero Waste Scotland. This longer run of data highlights diverging performance between the three schools, and is discussed at the end of this section.

There are some gaps and anomalies in the data which may explain the peaks and troughs in scheme performance during the formal pilot monitoring period:

- The Ardrossan figures include four weeks (August and September) where the machine was not in operation. If the retail sales for those four weeks are excluded, the Ardrossan capture rate is 25%, leading to an overall capture rate across all schools of 41.8%.
- There is also a gap in the Largs data for units recycled in two weeks in May. This was due to the need to install a three-phase electrical supply, which was specific to the model of the Recycle and

Reward machine used. If the retail sales for those two weeks are excluded, the Largs capture rate is 44.5%, leading to a slightly higher overall capture rate across all schools of 41.9%.

- The high capture rate for Garnock is driven by exceptionally high recycling figures for the first four weeks of the pilot, although the high capture rate did continue after that. Excluding the first four weeks, the Garnock capture rate would still have been 104% (420 units, 406 sales). There is no evidence to suggest that the Garnock figures are not accurate and so they have been retained in the analysis, but clearly the consumption and return patterns for containers at this site are quite different to the other two.

If both the Ardrossan and Largs data gaps are excluded, the overall pilot capture rate would be 45.8%, being 5,022 units recycled and 10,970 retail sales. This is quite high compared with most of the pilots. It is known that some of this material was imported (e.g. all the cans). This is not necessarily non-comparable with other schemes; it is simply that this effect can be seen with confidence for this material stream at these sites.

As noted, the retail sales data were available only monthly, so the following data use months as the basic unit of analysis. Four months of data are considered: two months either side of the summer holiday. Given the data gaps explained above, the data have been converted to average values within each month. This does mean the figures are slightly different from the overall results discussed above, but allows a more sensible 'smoothed' comparison over time. The data are shown in Table 5.

Value	School	May	June	August	September	Total
Vouchers issued	Ardrossan	105	80	–	17	201
	Garnock	132	54	56	23	265
	Largs	117	327	161	361	964
	Total	353	461	217	400	1,430
Retail sales	Ardrossan	294	346	–	253	892
	Garnock	19	63	21	29	131
	Largs	520	701	513	639	2,372
	Total	833	1,110	533	920	3,396
Capture rate (%)	Ardrossan	36	23	–	7	23
	Garnock	684	86	273	81	202
	Largs	22	47	31	56	41
	Total	42	41	41	43	42

Table 5 Average weekly capture rate figures per month per school and overall

The monthly capture rate is steady, with a very slight increase in the final month. This could be explained by a rising general awareness and increasing numbers of students using the scheme. During the autumn term, Waste Aware staff undertook talks at assemblies at Largs and encouraged teachers to do likewise at the other schools. This trend potentially underlines the importance of prolonged awareness and communications campaigns.

Subsequent monitoring by Zero Waste Scotland continued until the end of the autumn term. Only machine collection data were available, not sales and rewards information. At the headline level the collective performance from the North Ayrshire Schools remained consistent with the formal monitoring period. However, performance between the schools diverged significantly. Data for the three schools across both the independent monitoring period and the Zero Waste Scotland monitoring period are shown in figure 5.

There are no data from Ardrossan for weeks 16–19, as the machine was out of operation as previously noted. However, even once the machine was repaired, scheme use remained much lower than during the previous academic year. It may be that this break in service affected subsequent use, but it would also appear that use at Garnock declined in the second term. In contrast, Largs performed more strongly than ever, despite all three schools being a comparable size, and accounts for 79% of all returned containers over this longer period. The divergence over time is even more marked: Largs

was already the top performer in the summer term, accounting for 50% of returned containers, despite two weeks of machine downtime. Across the external monitoring period as a whole (so including the start of the autumn term as well, albeit with one site offline at the time and thus boosting this contribution) it accounts for 66%. However, in the final 12 weeks of additional data collection it accounted for 93% of all containers. Week 24 represents half-term at all sites.

4.2 Social research insight into items recycled

As discussed in section 4.1, the overall capture rate figures suggest that the scheme is quite well used, and student responses suggest more than half the students were using the machines to recycle at least some of their containers, as detailed in Figure 8.

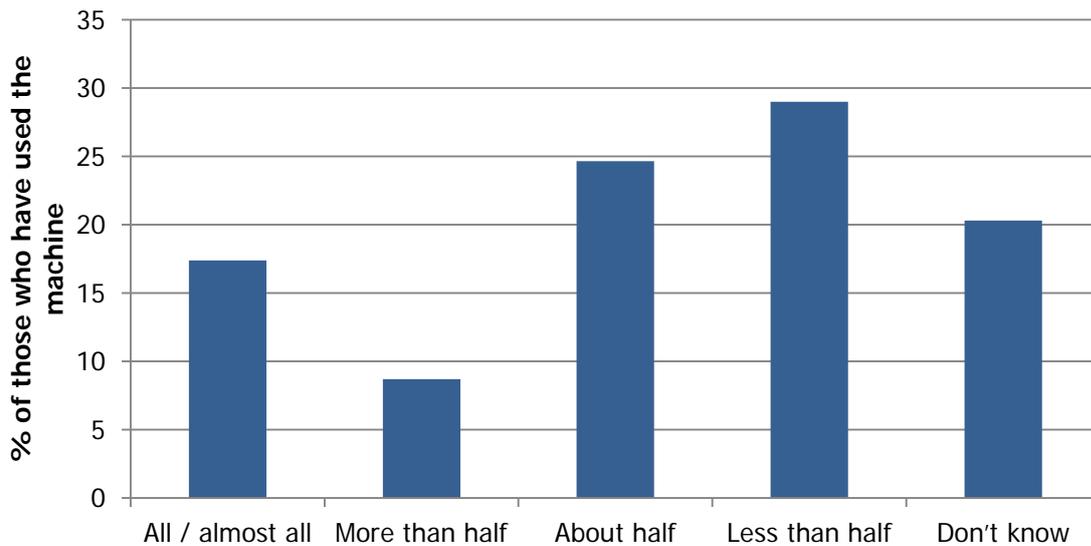


Figure 8 Proportion of plastic bottles and cans recycled using the machines

The vast majority of those pupils who were using the machines used them to recycle plastic bottles, as shown in Figure 9. The data from the machines support this, as they show that overall 88% of the recycling through the machines was PET bottles (and this was consistent across the three schools). Since no cans are sold at any of the North Ayrshire schools, all cans placed in the machines are imported from home or nearby shops.

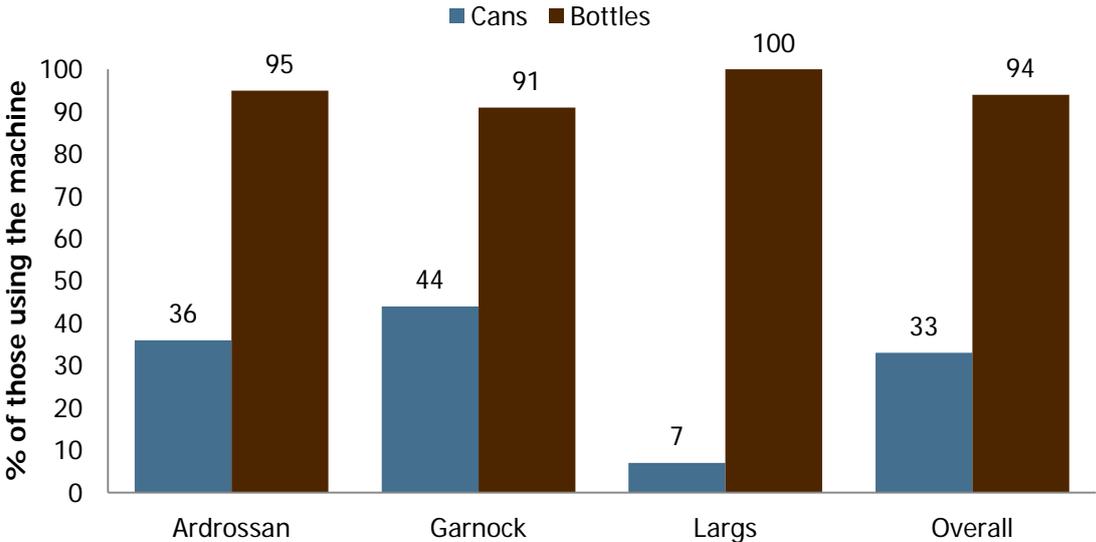


Figure 9 Materials recycled using the machines by school

The majority of pupils who used the machines reported previously putting their cans and bottles into rubbish bins at school (65%); not a surprise given the lack of recycling facilities at the schools before the pilot. The student responses are detailed in Figure 10. It is worth noting that, as there was no on site recycling before the pilot, the 10% claiming to have done so are mistaken.

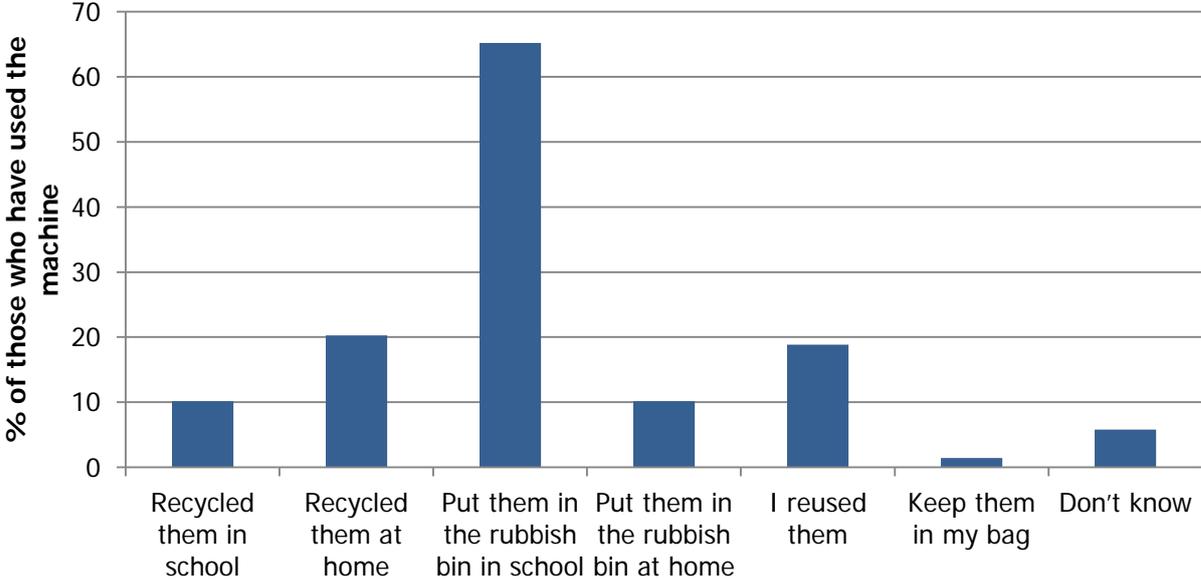


Figure 10 What users did with bottles and cans before the machines were introduced

A significant number of students explicitly claim to recycle more since the pilot's introduction: 35%. We would expect a significant change, since the scheme presents a new capacity to recycle the targeted items, not simply a new way of doing so. Perhaps the surprising figure is that so many state they recycle about the same as before; taken at face value, previous behaviour must have involved taking items off site for recycling, though there may be some inaccuracy in recall (as highlighted in the previous question). The responses are compared in Figure 11.

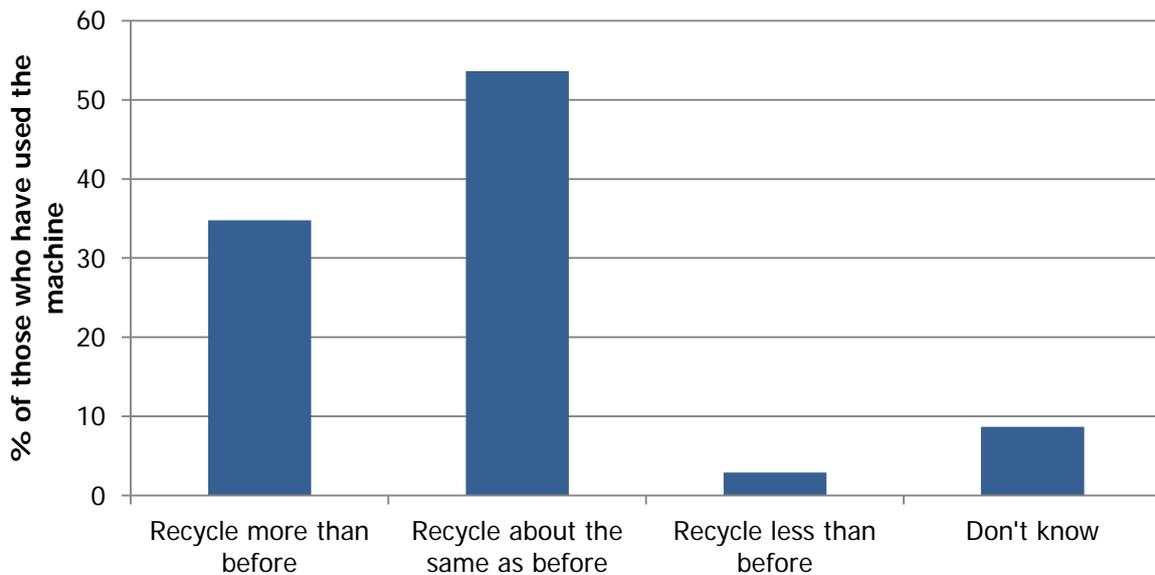


Figure 11 Recycling behaviour since the machines have been in the schools

4.3 Rewards issued and claimed

Each container recycled through the machines gave the user a voucher for 5p towards the purchase of a healthy meal option in the school canteen. To gain the voucher the user was required to press a button. There were two opportunities for a user to fail to redeem vouchers: not taking the voucher at the machine, and not using a voucher at the canteen. No separate data are available for these options, so the consideration of redemption rates combines both factors.

The number of rewards (vouchers) issued is available weekly but the retail sales data were only available monthly, so the following data use months as the basic unit of analysis. Four months of data are considered: two months either side of the summer holiday. The data have been shown as average monthly values and are shown in Table 6.

Value	School	May	June	August	September	Total
Vouchers issued	Ardrossan	105	80	–	17	201
	Garnock	132	54	56	23	265
	Largs	117	327	161	361	964
	Total	353	461	217	400	1,430
Vouchers redeemed	Ardrossan	14	15	–	12	41
	Garnock	38	33	13	10	94
	Largs	–	60	45	94	198
	Total	52	107	58	116	332
Redemption rate (%)	Ardrossan	13	18	–	73	20
	Garnock	29	61	23	42	35
	Largs	0	18	28	26	21
	Total	15	23	27	29	23

Table 6 Average weekly redemption rate figures per month per school and overall

Overall, the redemption rate grows each month of the pilot, peaking at 29%, with a pilot average of 23%. The redemption figures are not available by material type, but as the reward is identical it is unlikely that they would be different.

Figure 12 shows the overall voucher redemption rate. It reflects the data in Table 2 but corrects for the unavailable Largs May figure and the Ardrossan August figure, using an average for each school. This has been done to show that the second month's improvement in redemption rate is reflected in a full dataset and not related to missing data.

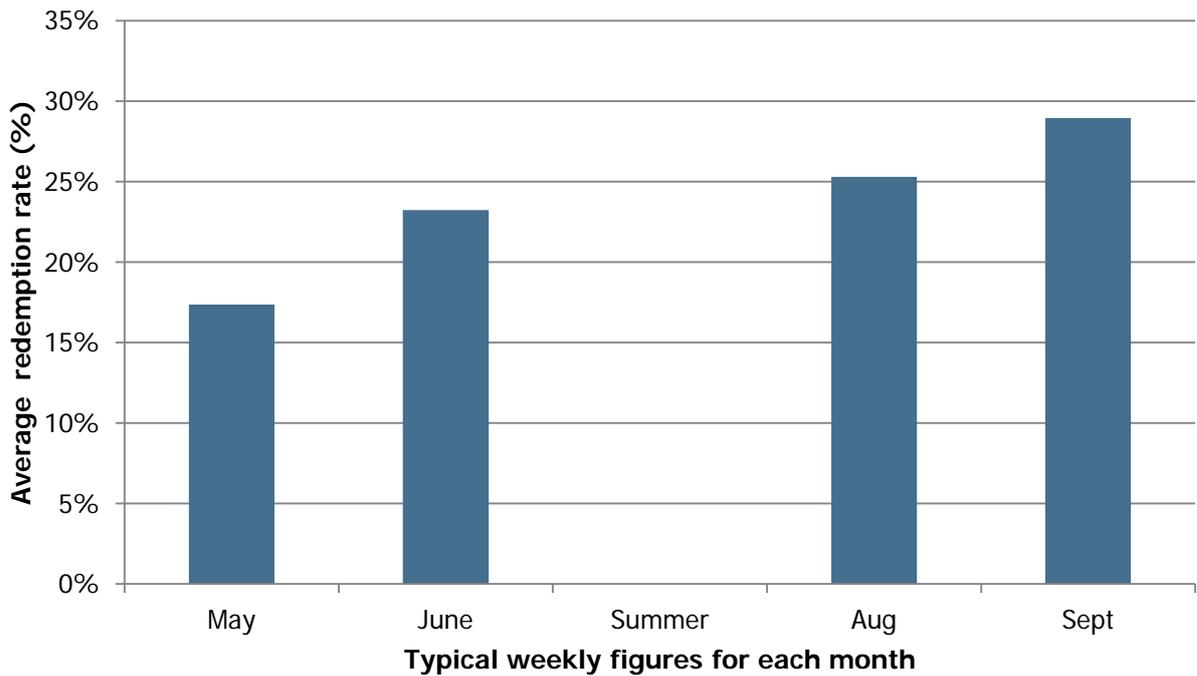


Figure 12 Corrected average weekly redemption rate per month

The above graph suggests a broad month-to-month improvement of redemption rates, but that the summer break caused a small setback to the rate of improvement in performance. New and returning pupils, however, improved the pilot's redemption rates over time, possibly because awareness of the pilots' benefits spread within the school community.

There are no clear data on whether there was any lag in the use of vouchers, or voucher stockpiling. The limited observation data identified that all three of the pupils used their vouchers straight away in the school canteen, whereas the teacher put the voucher in their wallet.

4.4 Awareness of the machines and their correct use

Overall, pupils found the machines easy to use. Of those pupils in the North Ayrshire schools survey who used the machine, the majority (82%) strongly agreed or agreed with the statement 'The machine is easy to use', as detailed in Figure 13, although, as noted above, further signage was added during the pilot.

In the limited machine observations undertaken at Garnock Academy, users appeared to understand how the machine worked, and all took the reward voucher.

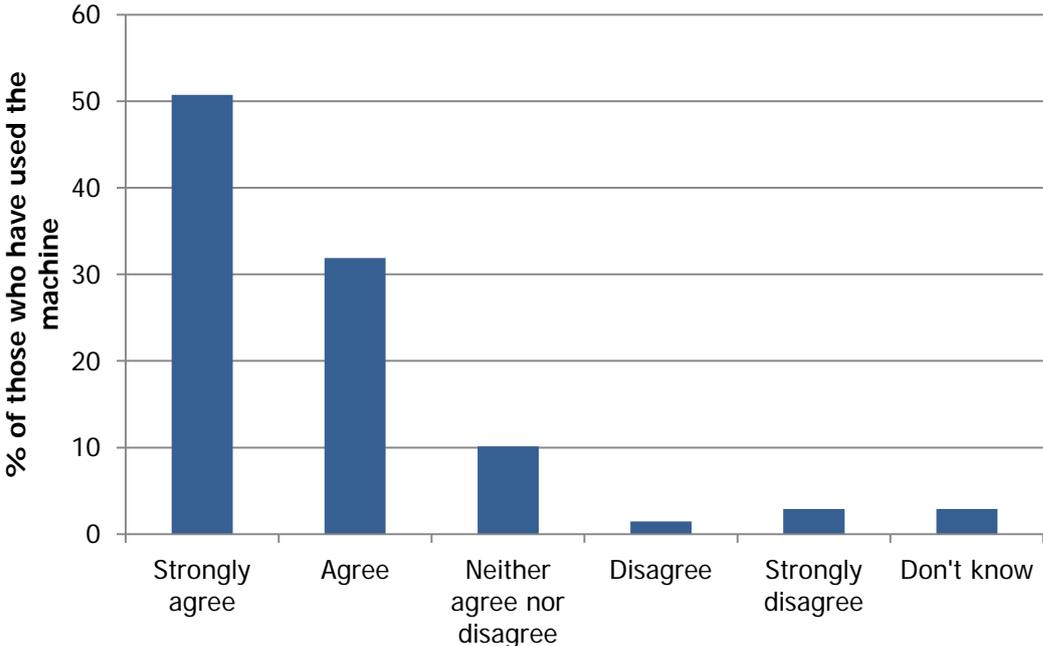


Figure 13 Agreement with 'the machine was easy to use'

4.5 Impact on litter

To understand the impact of the pilot on waste management behaviours, a waste composition analysis was conducted. This analysed litter picked from the school grounds by the janitors.

For the baseline, 23.0kg of litter was obtained. It should be noted that a small part of the litter sample was discarded during storage, leading to a smaller sample than otherwise would have been the case. For the in-pilot sample, 34.1kg of litter was obtained. Given the snapshot nature of the data, and the missing litter, the results are broadly comparable and no conclusions can be drawn from the weights alone.

The results of the compositional analysis are detailed in Figure 14, and show a slight reduction in the proportion of aluminium cans and PET bottles in litter. The reduction in targeted recycling materials in the litter is small, at roughly 25%, and mirrors an overall reduction in most streams. The food waste element showed the only significant increase, but this was very large. Changes can just as easily be ascribed to random variation as to genuine change

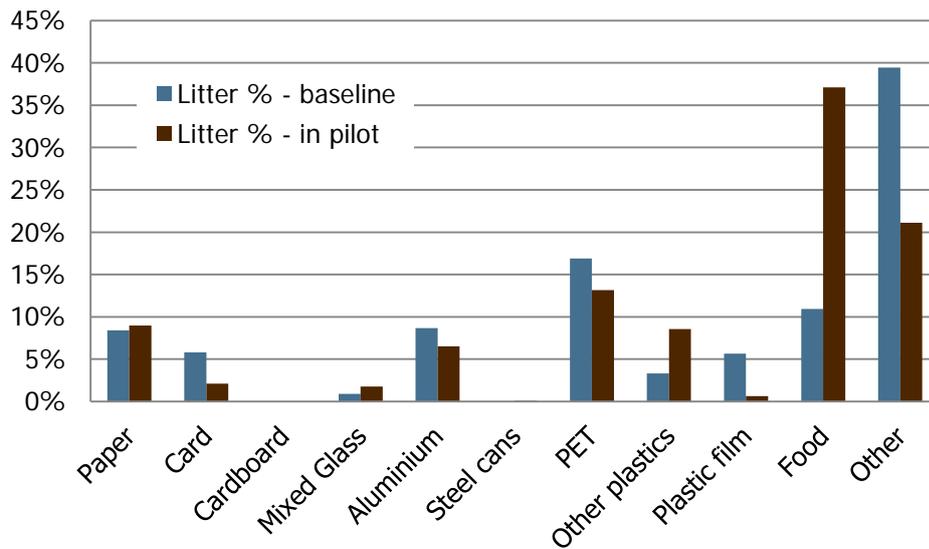


Figure 14 Baseline vs in-pilot litter composition (from the grounds litter pick)

4.6 Impact on overall waste

It is difficult to assess the impact of the pilot on waste because there are no detailed baseline or in-pilot waste management data and the materials targeted and captured by the machines are relatively low in weight. As discussed in section 3.1.2, an estimate of annual waste arising (for a typical year) was made by multiplying factors provided by the waste contractor. These numbers can be treated as indicative of the scale of waste on site, but not as an accurate baseline.

The results were:

- 7,054kg per week of residual waste, based on 23 residual commercial 1,100-litre bins, 100% full on average, lifted twice per week, containing waste with an estimated bulk density of 154.2kg/m³, for schools open 77% of the year; and
- 20kg per week of recycling, based on five 1,280-litre and four 1,100-litre paper or card recyclable bins, 100% full on average, lifted twice per week, containing waste with an estimated bulk density of 176kg/m³ for paper and 13.5kg/m³ for card, for schools open 77% of the year.

The pilot was over 14 weeks, so the schools would have generated an estimated 284kg of paper and card recycling and 98,800kg (~99 tonnes) of residual waste.

SKM data, gathered during the pilots, gave standard container weight figures of 0.014kg per aluminium can and 0.022kg per PET bottle. Combined with the number of units recorded by the machines, this would suggest that 9kg of cans and 97kg of PET bottles were collected during the full 14 weeks of the pilot, a total weight of 106kg. The effect of the pilot at North Ayrshire schools would therefore have been only ~3% of the total recycling and ~0.1% of the total waste. It is therefore unlikely, given natural variation, that any statistical impact would have been noticeable even if weekly waste weights had been available.

Anecdotal evidence from school janitors was that:

- the residual waste collection containers remained very well used during the pilot, especially at Ardrossan, where it was not uncommon for bins to be overflowing; and
- the overall volume and type of waste were not noticeably changed by the introduction of the machines.

To understand the impact of the pilot on waste management behaviours, a waste composition analysis was conducted. It analysed wastes disposed of in residual waste bins (black bag) within each school's canteen area. As noted earlier, waste samples were collected over just one day for the baseline and one day for the in-pilot period. The analyses should be seen as a snapshot as opposed to a detailed understanding of the schools' waste profiles.

For the baseline, 52.6kg of black-bag waste was obtained and, for the in-pilot sample, 66.0kg of black-bag waste was obtained. In both cases the sample represented one day's waste from litter and from the bins around the canteen. Again, given the snapshot nature of the data, the results are broadly comparable and no conclusions can be drawn from the weights alone.

The composition of baseline and in pilot black-bag waste samples is as detailed in Figure 15. Potential recyclable materials and food were segregated, leaving 'other' waste. The PET in the black-bag waste was roughly similar in both cases (8% baseline and 9% in pilot). The aluminium was 1% in both cases.

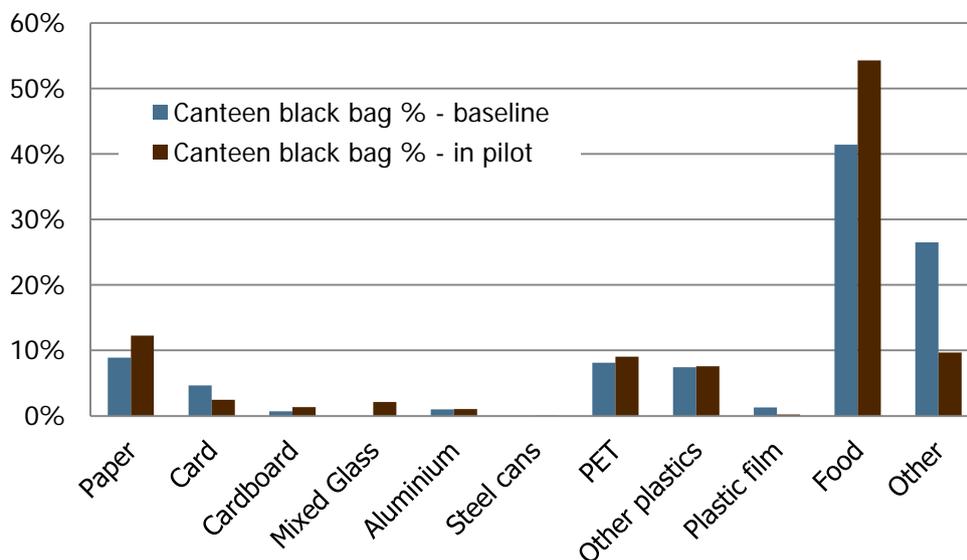


Figure 15 Baseline vs in-pilot black-bag waste composition

4.7 Impact on container sales

With regard to the impact on container sales, monthly sales data were available for the pilot period and for the comparable baseline months in 2012.

The analysis of the four baseline months (May, June, August and September) with the pilot shows an overall 17% reduction in sales: from 15,494 to 12,929 containers. The reduction is smallest at Ardrossan (2%) but 36% at Garnock and 21% at Largs. It is not an even decline: May is down 12%, June up 9%, August down 47% and September down 24%. It seems unlikely these changes are motivated by the pilot; as it is a reward scheme, the price of items did not change and, as items from outside the school could be used to claim a reward, there was no particular incentive to buy on site as opposed to off site.

No population data are available to confirm if the number of students was similar. Equally there are no baseline data outside the pilot period to indicate whether or not there is a general reduction in sales between 2012 and 2013.

The other evidence would suggest that there was no impact:

- In the survey, most students (68%) said their purchasing behaviour remained the same following the introduction of the machines in the school. Only 9% of students said they bought more in school than before and 9% said they bought less than before. The remaining 14% did not know.
- The trend of sales (Figure 16) shows an increase across the first two months of the start of the pilot, dipping at the start of the new academic year, and then increasing in the last pilot month.

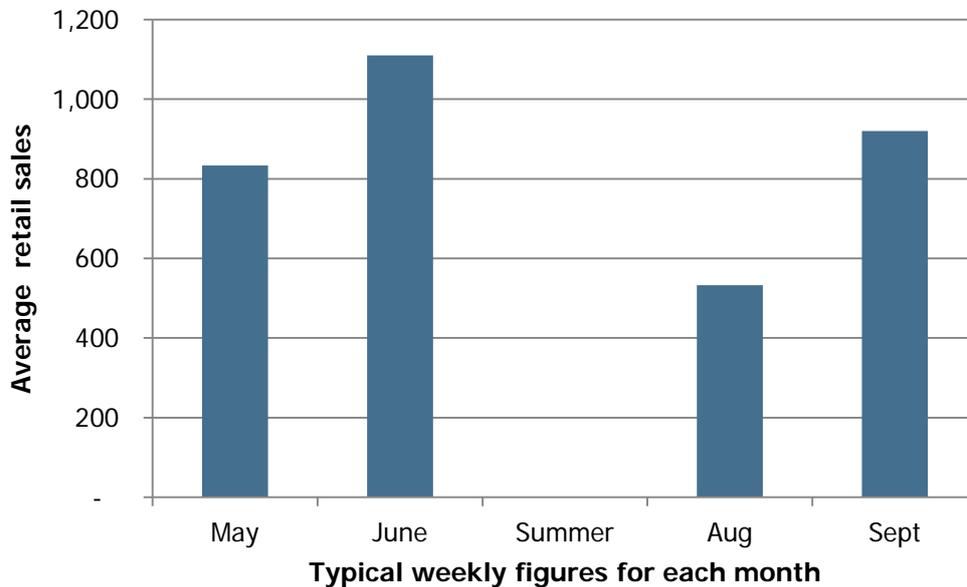


Figure 16 Average weekly retail sales in each month

4.8 Impact on material quality

The machines did not accept opaque drinks bottles or steel cans, which were rejected; hence the opportunity for contamination was low. Recycling bins were placed next to machines to facilitate collection of rejected items. Based on SKM observations and anecdotal evidence, the machines produced two clean, homogenous streams uncontaminated by foreign objects.

4.9 Operational factors

This section considers the machines' technical reliability, and also how reliability was perceived by users and staff. It also considers the resourcing implications of the scheme for the site, specifically where these diverged from initial expectations.

4.9.1 Machine reliability

Over the pilot, the majority of those in the social research survey felt the machine was not available all the time; in fact only 40% of pupils strongly agreed or agreed with the statement 'The machine always works', as displayed in Figure 17.

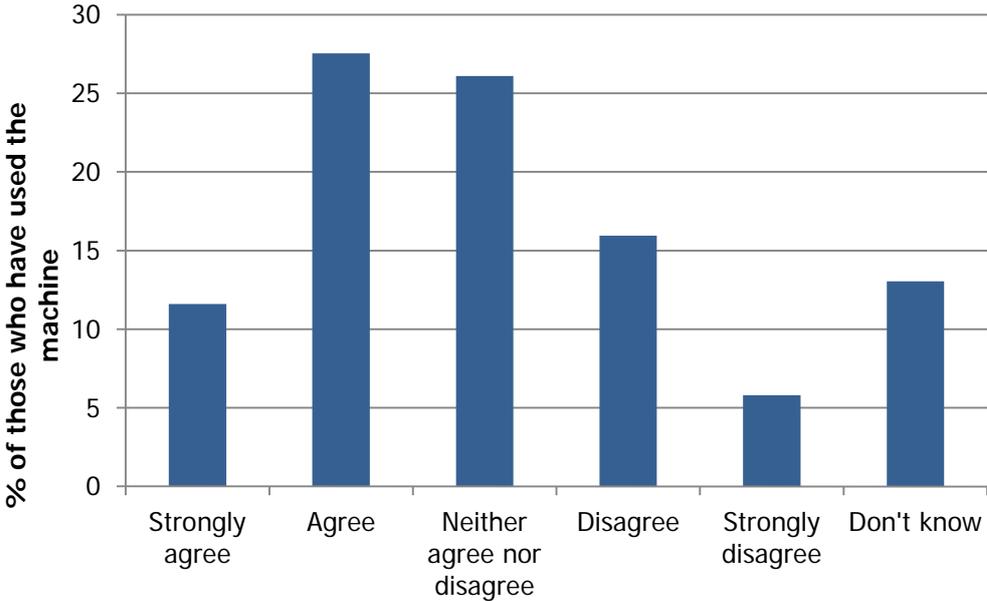


Figure 17 Reliability of the machine

At Largs Academy, the machine was out of operation for two weeks in May, following the launch of the project. This was because a three-phase electrical supply needed to be installed; the electricity within the school required adjustment to provide capacity for the machine. This issue took several weeks to diagnose and solve.

At Ardrossan, the Recycle and Reward machine was out of use for the first four weeks of the autumn term due to an incident of vandalism.

Other than these exceptional events, which probably coloured the views of those surveyed, the Recycle and Reward machines were reliable and in operation at all the schools for the vast majority of the time, although there may have been downtime due to the need for emptying.

4.9.2 Resourcing implications

The pilot was administered by North Ayrshire Council’s waste services department. The janitors at each school operated the machines, accessed readings, emptied the collected cans and bottles, reported any faults and liaised with North Ayrshire Council waste services and Revendit Ltd (the equipment supplier) in addressing technical issues.

Staff from the council’s Waste Services Department were assigned to assist with the scheme, including installation of hardware, setting up voucher redemption systems at the canteens, ongoing support to the project, troubleshooting, development and dissemination of communications materials with which to promote the scheme, and other ad hoc support. No staff were assigned full time to the project so it is not possible to isolate the council’s staffing costs attributable to the project.

5 Public reactions to the pilot

In assessing public reactions, this section considers the views of only the target population for the scheme – which was also the target population for the social research – plus any staff or site insight. This section first considers user and non-user views in isolation, before discussing the extent to which the rewards themselves were seen as appropriate more generally. It then discusses the legacy of the system: the extent to which users and the site

wish to see it continue, and whether or not it will. A final section summarises the perceived benefits of the scheme.

5.1 User views and motivation

The survey asked if the respondent was a user of the Recycle and Reward machines. The results shown in Figure 18 demonstrate that there were more non-users than users at each school. The proportions of pupils using the Recycle and Reward machine were:

- Ardrossan Academy 28%;
- Garnock Academy 47%; and
- Largs Academy (junior pupils only) 41%.

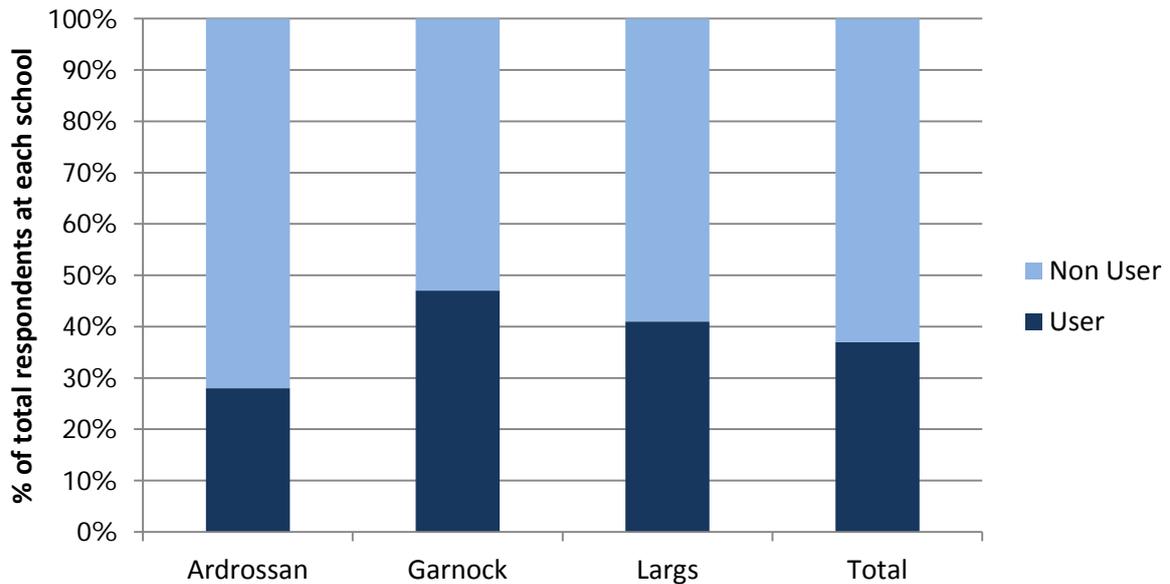


Figure 18 Proportions of non-users and users

The proportion of pupils using the Recycle and Reward machines varied by gender; machine use was consistently higher for girls across all schools (noting that the survey respondents were approximately even between boys and girls). The figures are detailed in Figure 19.

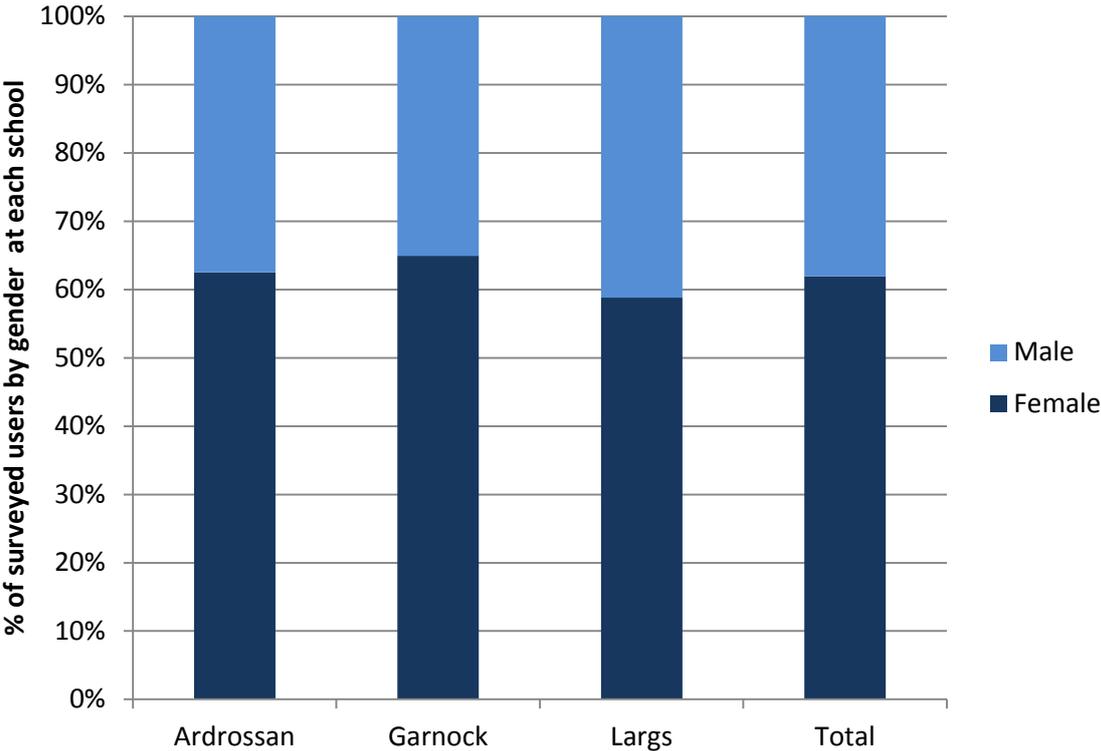


Figure 19 Recycle and Reward use by gender

All participants of the user survey were asked what communication materials had encouraged them to use the machines. The most common form of encouragement was simply seeing the machines (44%). Face-to-face communications were also important across all schools; many were told about the machines by a friend (26%). Both the teaching and canteen staff also helped to raise awareness in the North Ayrshire schools.

When asked what promotions they could recall, people remembered word of mouth and sight of the machines more than the printed material such as posters in the vicinity of the machines (Figure 20). It is worth noting that the same survey was used at North and South Ayrshire schools, but North Ayrshire Schools did not have a Community Police Officer. The small number of responses of 'Community policeman' are therefore mistaken.

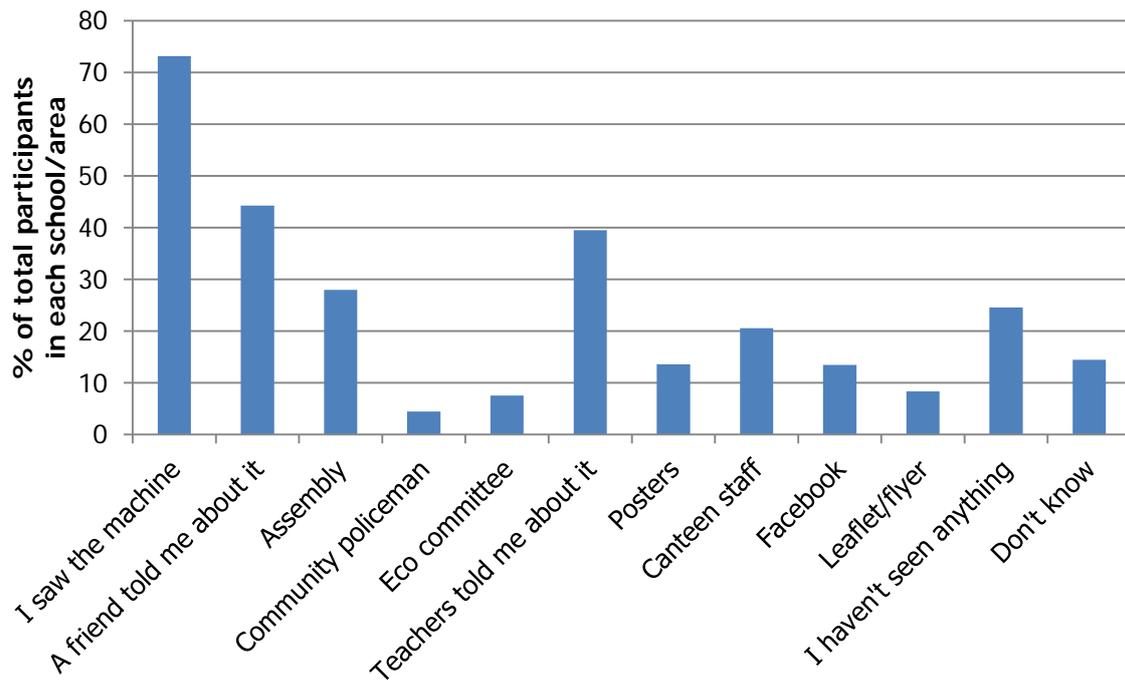


Figure 20 Promotional activities recalled by participants

5.1.1 Frequency of machine use

The majority of pupils who used the machines in North Ayrshire claimed they had only used them once (51%), 15% less frequently than once a week and 22% once or more per week. Only 13% had used the machine more than once a day.

5.2 Non-user views

The proportions of respondents to the pupil survey not using the Recycle and Reward machine were:

- Garnock Academy 53%;
- Largs Academy 72%; and
- Ardrossan Academy 72%.

The most common reasons that the non-users reported for not using the machine was that they did not have any plastic bottles or cans (23%). A similar proportion of non-users said they hardly used the machine because they could not be bothered/were too lazy (29%).

The most common response when pupils were asked what would encourage them to use the machine was a better reward (49%). This is slightly at odds with the results expressed in section 5.3, but may be borne out by the voucher redemption rate seen in this pilot as opposed to some others.

5.3 Appropriateness of the rewards

Of all pupils surveyed at the North Ayrshire schools, 62% agreed with the statement 'I think the reward is appropriate', as detailed in Figure 21.

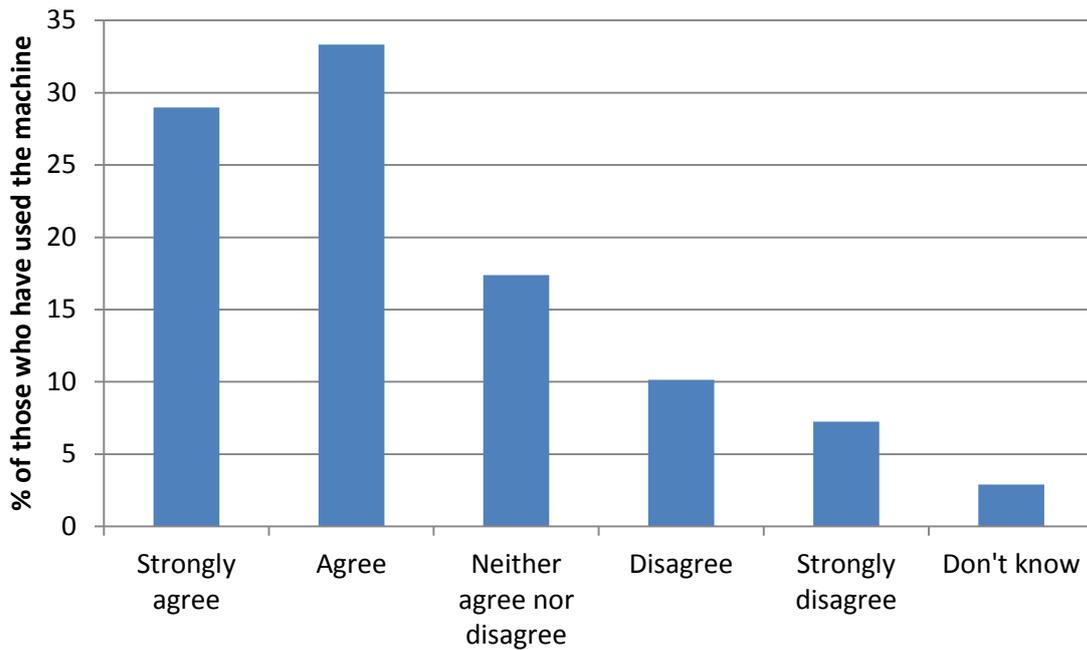


Figure 21 Appropriateness of the reward

5.4 Legacy of the Recycle and Reward scheme

Figure 22 shows the results from the student survey on whether the schemes should continue. Whilst overall only 7% thought definitely not, 38% thought it should and 56% were generally unsure. Largs Academy had the greatest support for the continued use of the scheme (and also saw the greatest volumes in the performance data).

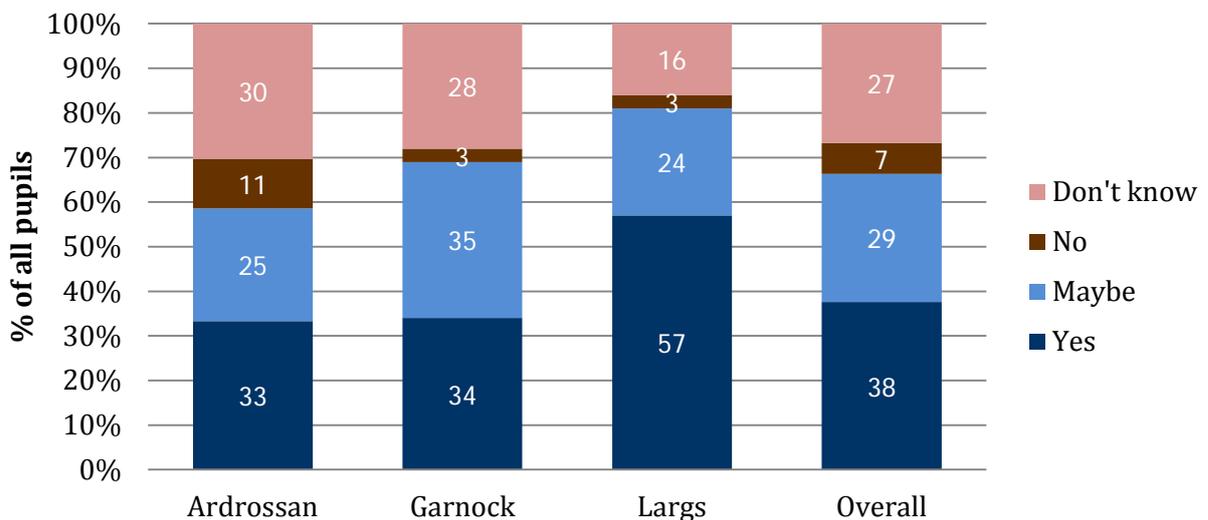


Figure 22 Whether pupils would like to see the machine in the school permanently

5.5 Other observations

The main benefits of the Recycle and Reward pilot identified by the pupils were:

- the reward (29%);
- it encourages recycling (13%);
- it's good for the planet/environment (11%); and
- it reduces litter (6%).

Staff identified the key benefits as increasing 'awareness of recycling and improves recycling rates' and 'reduction in litter around the school'.

6 Conclusions

Fewer than half of the survey respondents (37%) had used the machine, and 51% of these had used the machine only once. Only 17% of students who had used the machine now used it to recycle all of their plastic bottles and cans that they consumed in school, but the majority of students (51%) using the machine disposed of more than half their cans and bottles through it.

Over the full pilot period, 5,022 units (cans and bottles) were recycled through the machine, representing an overall capture rate of 39% across the pilot (34% if measured as sales against PET recycled, because cans were not sold). Taking out those weeks when the machine was down brings the capture rate to ~46% (40% if measured as sales against PET recycled), which is a good result compared with many other pilots. It has to be noted that while users of the scheme mainly recycled containers from the school retail outlets (59% of the users stated this as the source), many had recycled containers from nearby shops (51%) or home (33%). This may therefore have caused some displacement effect, taking containers that were already being recycled at home to school to receive a reward. However, it seems more likely that these containers typically represented the import of products to be consumed on site. Imports were highest at Garnock (which had lowest on site sales) and redemption rates on vouchers were relatively low, suggesting the reward was not driving imports of materials particularly strongly.

As cans were not sold at the schools, the majority of recycling was PET bottles. Some 69% of users said that previously they had put cans and bottles in the school bins, and 35% said they now recycled more than previously (54% claiming to recycle the same). This was the only pilot site that had no provision for recycling the target containers before the pilot. Thus any behaviour change from the pilot cannot necessarily be attributed to the reward scheme; enhanced provision may also be a key driver. However, it also means all containers represent an improvement in recycling for the site (assuming diversion from elsewhere to be minimal).

The number of units recycled accounts for only about half a container per month per pupil, though not all pupils will consume the target materials. The total weight of recycling was small against the overall waste stream for the schools, reflecting the material types concerned as much as the capture rate; even a 100% capture rate of all sales on site would be small in comparison with the overall waste stream. The actual weight of material recycled through the machine during the pilot was only 0.1% of the pilot schools' total waste over the same period (and only 3% of total recycling – though much of the recycling figure will consist of much heavier items such as paper).

While some pupils and staff felt that litter had been reduced, there was no strong quantitative data to support this; the snapshot provided by compositional analysis was potentially subject to too much natural variation for robust conclusions to be drawn. There is contradictory evidence on sales, with an absolute drop in sales from the same period in 2012, but the survey suggested that purchasing of cans and bottles had not been affected by the pilot; given the design of the scheme there is no real reason for it to have an impact on sales (prices did not change, and non-scheme containers could be used to claim a reward) so it seems likely any changes in sales are coincidental.

Of the surveyed students who used the machines, 82% said that the machine was easy to use and, overall, 62% of surveyed pupils thought the rewards were sufficient. The voucher redemption rate,

however, was only 23% across the whole pilot period, implying that the value of the reward was not the most significant driver of behaviour.

The most effective (or at least most memorable) means of promoting the pilot was verbal: through word of mouth, assemblies, teacher briefings and seeing the machines, rather than printed/branded communications. No extra resources in terms of staff numbers were needed for the pilot, and no one was assigned to it full time, although the pilot did need the support of school janitors and council waste services officers.

The legacy of the pilot is very much in line with the general take-up, with 38% of pupil survey respondents wishing to see the pilot remain. Only 7% did not want it to remain, though a large number were unsure. As of April 2015, two sites continued to operate a scheme.

Overall it seems fair to say that the scheme successfully captured recyclate during the pilot period, though the target materials are a small part of the overall waste stream. However, subsequent data from the autumn term collected by Zero Waste Scotland shows that, while overall scheme performance was maintained, divergence between the schools was significant, with just one of them accounting for the lion's share of returns, and the other two seeing absolute falls. Although there is insufficient supporting evidence to identify the reasons for this divergence, it is not unreasonable to conclude that the scheme has only truly become embedded in behaviour in one of the three locations. Interestingly, this was also the location where the survey saw the most enthusiastic pupil response to scheme continuation.

7 Glossary of terms

- Capture rate: the proportion of targeted containers that are recycled through the system.
- Collection: the return of containers to the reverse vending machine.
- Deposit: the 10p charge placed on an in-scheme container.
- In-scheme: a container that was sold within the university with a deposit charged.
- Non-user: person who has not used the Recycle and Reward scheme, or has used it but does not intend to again.
- PET: polyethylene terephthalate.
- Reverse vending: accepting an item for recycling in a machine that issues a reward or other incentive.
- Shelf talker: card or sign attached to a shelf to highlight a product or promotion.
- Transaction: a visit to the reverse vending machine by a user placing one or more collected containers in the machine.
- Units/containers: the aluminium cans, PET plastic bottles or cups.
- User: person who has used the Recycle and Reward scheme more than once.

Appendix: monitoring methodology

The monitoring and evaluation work for the pilots was led by SKM Enviros (SKM), working in partnership with Nicki Souter Associates (NSA). At the educational sites, Zero Waste Scotland undertook additional data collection outside the trial period, so a complete dataset could be obtained for the autumn term.

The range and number of data collected varied somewhat by site, reflecting constraints on what sites knew, and the cost-effectiveness of obtaining certain types of data in some contexts. As the pilots progressed, the balance of monitoring was adapted to concentrate on those sites which would be most likely to provide useful learning. This particularly affected strand B, where it was felt that, firstly, concentrating some resources on key sites could help offset some of the limitations on the strand A data and, secondly, some sites were experiencing relatively low footfall and would be far less cost-effective to target in data collection terms.

Data collected and methods employed included the following. Some differences between sites are highlighted here, whilst the approach for specific sites is in tabular form below.

Strand A

Baseline retail sales data for the site – some sites had only annual data, others monthly and some only partial data. In one case (HebCelt) there were no historic data, and in another (Troon HWRC) no sales data were collected either before or during the trial, as the target area was too broad.

Pilot period retail data – all sites but Troon HWRC provided these data. Typically data were either weekly or monthly depending on the sales systems and number of outlets that were relevant to the site.

Baseline waste management data for the site – some sites had monthly data and one site (Dundee) sought to estimate weekly information. However, several sites had no baseline data. All sites struggled to provide detailed waste information (e.g. the composition of drinks containers by stream, or weights rather than volume-based estimates).

These are common challenges in trials of this type, and could be comprehensively tackled only by a year-long resource intensive pre-pilot monitoring period. In an attempt to improve understanding, in two cases (Heriot-Watt and the North Ayrshire schools) waste compositional analysis was undertaken before and during the trial. Site visits in all cases where it was appropriate also included visual estimates of container fill rates and contamination, and discussion with site staff to understand collection frequency, but, while this improved our understanding of material flows, it was insufficiently sensitive in itself to highlight change over the trial period.

Waste management data during the pilot period was available for all sites, but granularity and quality varied. Most sites knew their overall waste arisings and some knew recyclates within that. In two cases (as noted above) compositional analysis was undertaken to try to understand residual composition. Sites provided data from a mix of volume-based measures, weight information, and site and waste contractor information.

Returns data from the recycle and reward machine(s) and/or manual data during the trial period were collected. Where both were available they were sense-checked against each other. Typically the manual data were preferred in those cases where there was a contradiction (for example, switching the power on and off was found to have led to the machine resetting the count at one site).

Machines recorded transaction data in different levels of detail (daily, weekly or by individual transaction). Most machines recorded data by container type; in one case the machine collected mixed plastics and cans in a single receptacle and in this case the split of material was estimated during site visits.

The level of analysis that these data could be subjected to varied according to the format obtained.

Downtime data during the pilot period – some machines also provided telemetry data when they were offline (either for servicing or emptying, or because of a problem), and some sites provided these data. However, it was not always clear at all sites how long machines were down for.

Redemption rates during the trial period – the machines identified how many vouchers were issued (where this differed from the number of containers returned, e.g. where some containers did not attract a reward, or rewards were given to charity). Voucher redemption data were collected from the retail outlets either monthly or weekly. The level of analysis that these data could be subjected to varied according to the format obtained, and how closely they matched the machine data in time periods covered.

Site visits were conducted to understand waste management practice, to help gather baseline data and to build a relationship with the sites to facilitate the overall monitoring. SKM staff originally proposed to visit each site (with the exception of HebCelt, which it was sensible to visit only during the pilot) at least twice (once before the pilot and once during it). However, for some sites the number of visits was increased, where it was felt this would enable the collection of better baseline data, addressing some of the gaps in pre-existing records.

Although not formally part of the monitoring process recorded here, all sites (except HebCelt, though other Zero Waste Scotland staff were present) received multiple visits from the Zero Waste Scotland project manager. Especially during the early trial period, these were often weekly for some of the bigger sites. Zero Waste Scotland staff were also available to troubleshoot problems remotely (by phone and email) and this also means we obtained data on much of the learning around set-up and installation. These visits were therefore invaluable both in delivering the pilots and also in providing insight into how they were functioning on the ground, and what was and was not working well. Visits included an assessment of reliability, and material quality, on several occasions. Zero Waste Scotland also made several other visits to sites to assess communications and scheme performance; these included informal 'mystery shopper'-style use of the machines. NSA also visited all sites where they conducted fieldwork at least once, and provided feedback on how well the scheme was functioning at the time of their visits.

Throughout the pilot period SKM, NSA and Zero Waste Scotland liaised closely on issues encountered.

In some cases, site visits included visual (including photographic) inspection of residual bins, recycling bins or the recyclate collected from the machines. In a few cases, site waste management staff were able to supplement data gathered this way independently of a visit from the monitoring team.

Strand B

Focus groups were concentrated on the university sites, which saw relatively high levels of use, and an audience that was accessible for this form of research. Despite the variation in scheme design, these three institutions are of course broadly similar in function, so it was also felt cross-site comparison would add most value to focus groups conducted in these contexts.

Face-to-face (and online) surveying was concentrated on the university sites and HebCelt, as these saw the highest footfall and were thus most appropriate for an in-situ survey technique. Thanks to patterns of use at these sites, an in-situ technique also has a good chance of reaching a representative set of users, and (albeit to a somewhat lesser extent) relevant non-users (i.e. those who use the public areas targeted, but not the scheme). The samples obtained in these cases do allow for quantitative analysis.

At Dundee, an online survey to students managed by the university also asked about reactions to the Recycle and Reward scheme, and the results were kindly shared with Zero Waste Scotland. These

provide an interesting perspective, as the respondent base and time period differ somewhat from the external monitoring undertaken.

At the Ikea stores and Troon Household Waste Recycling Centre an interviewer was placed on site for a day in each case, but, as expected, relatively few interviews were obtained because of the lower footfall. The responses obtained here provide customer insight, but are too small to be analysed quantitatively.

In the school context it was felt that an online survey was a cost-effective alternative to face-to-face surveying (all students can be contacted in this way, and can be encouraged to participate by staff). Numbers were relatively small, but can be considered quantitatively (with caution).

An online survey was made available at Whitmuir (using its customer database), as it was felt that on site surveying would yield too few users to be worthwhile. Very little feedback was obtained via this route (which is also a somewhat selective sampling method, as not all customers are on the database – though regular customers, which the scheme expected to target primarily, were).

Observations were also concentrated on sites where footfall was highest, but were employed to some extent at all sites except Marr (as Zero Waste Scotland considered the schools in North Ayrshire to provide sufficient insight) and Whitmuir (where machine use was very low). The extent to which the observations can be analysed quantitatively is dependent on the number of transactions actually observed in each case.

Insight from formal observations is supplemented by the insight gained during site visits by SKM, NSA and Zero Waste Scotland throughout the trial period, and feedback from site staff (about both what they have observed, and what customers have told them). This provides a useful perspective, in conjunction with other sources, both on changing behaviour over time (in particular the extent to which the observed periods at the universities may have been atypical, as they were near the start of term) and on behaviour outwith the monitoring period (for example, use by cleaning staff at some sites particularly in the early morning).

In-depth interviews were carried out by NSA at a smaller number of sites. These sites were selected by Zero Waste Scotland on the basis that they would provide most additional insight. The interviews targeted a range of site staff including management, cleaning and retail staff. The excluded sites were those where Zero Waste Scotland had had particularly extensive contact throughout the trial period, and it was felt staff insight and reactions were already well understood. Zero Waste Scotland has fed into the reporting process in all cases.

General

Although presented as strands A and B in research design, with SKM undertaking the fieldwork and analysis for strand A and NSA doing so for strand B, the final reporting and analysis for all cases, and the overview report, have been led by SKM, working closely with both NSA and Zero Waste Scotland. Throughout the process, the project team across the three organisations met regularly to exchange information and insight, and, particularly in terms of insight into site management and scheme performance, all three organisations gained insight from their respective site visits. The reporting should thus be seen as an integrated report, drawing on both technical data and analysis, and quantitative and qualitative social research.

Key challenges in interpretation and analysis are highlighted in the main report at section 2.4, and where appropriate when presenting specific findings. Table A1 shows the detail of monitoring across sites, including variation.

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	Pilot Project	Hard' Performance Data - baseline (pre-pilot)			Hard' Performance Data - during pilot							Strand B				Other information	
		Baseline retail data	Baseline waste management data	RVM data manual record	RVM data telemetry	Retail data	Voucher data	Waste Management data	Machine downtime	Site visits	Other in depth analysis	Focus Groups	Depth interview (days)	Observational analysis (days)	Face-to-face surveys (total number)	Site Specific data limitations	Other supporting information
Universities	GCU	Supplied approximately weekly by the General Manager of Catering Services	Supplied as monthly data by the Sustainability Coordinator	Supplied approximately weekly by the General Manager of Catering Services	Machine supplier provided data approximately weekly.	Supplied approximately weekly by the General Manager of Catering Services	Supplied approximately weekly by the General Manager of Catering Services	Supplied monthly by the Sustainability Coordinator	Limited data from machine supplier (machine ID but not date/duration)	5	Photographic/observational bin audits (6:5 by SKM staff; 1 by GCU staff)	2	0	3	250	Early weeks recorded as a total value. No machine downtime data provided by GCU. Procurement of drinks containers based on existing process rather than sensitive to current patterns.	
	HWU	Comparable data not available	Annual data available	N/A	Machine supplier provided weekly; data available at an hourly level	Supplied weekly by the Hospitality Services Manager and Student Union Manager	Supplied weekly by the Hospitality Services Manager and Student Union Manager; machine supplier provided weekly data on vouchers issued	Unavailable so waste compositional analyses undertaken	Machine supplier provided weekly	3	2 waste compositional analyses (prior and during trial)	3	1	2.5	500	The data provided by Hospitality Services of units sold in retail outlets was initially understood to be PET bottles only as no cans were sold in retail outlets. However it became apparent in the latter stages of the trial that a small quantity of cans is indeed sold in retail outlets. This has led to an unidentifiable but small number of cans sales being reported as PET bottle sales	
	UoD	Provided by DUSA based on actual sales in the two campus shops during one term-time week, an estimated figure for weekly term-time vending machine sales and an estimate for expected sales (from shops and vending machines) during holiday periods.	Estimated weekly data on segregated recyclables provided by University based on container fullness rather than weight; estimated annual tonnages of segregated recyclables from teaching and admin buildings supplied by University waste manager; also monthly residual data excluding May to July 012	Supplied approximately weekly by the Environment and Sustainability Officer	Machine supplier provided data approximately weekly.	Supplied monthly by the Environment and Sustainability Officer/DUSA Shop and Vending Manager	Environment and Sustainability Officer provided data on the total amount invoiced by DUSA (variable frequency)	Data on for recycling from RotG banks, Halls of Residence supplied monthly by Dundee City Council; University Waste Manager supplied weekly data on University residual waste	Supplied approximately weekly by the Environment and Sustainability Officer; limited data from machine supplier (machine ID but not date/duration)	1	N/A	2	0	3	250		
HWRC	Troon	N/A	No data available	Total units data provided weekly by Council staff; data on bottle/can split only provided as overall ratio provided at end of trial	N/A	N/A	Monthly data provided by HWRC staff at end of trial	Material collected in combination with other recyclates so no data available	No data	2	N/A	0	1	1	1 day		
Schools	Marr College	Baseline vending sales data was available from DC7 Ltd but not from the school canteen	No data available	Weekly data provided by the community policeman	N/A	Weekly data supplied by canteen staff and monthly data for the vending machine was provided by DC7 Ltd	Data provided by the community policeman and the eco-committee	Only estimated data available	No data	2	N/A	0	1	0	50		
	NAC Schools	Monthly data supplied by each school's canteen staff	No data available	Janitor from each school provided a weekly record excluding summer holiday period	N/A	Monthly data supplied by each school's canteen staff	Monthly data supplied by each school's canteen staff	Only estimated data available so waste compositional analyses undertaken	Janitor from each school provided a weekly record excluding summer holiday period	3	2 waste compositional analyses (prior and during trial)	0	0	1	50 per school		
Retail	IKEA Edinburgh	Monthly data for Britvic vending machine sales only	Very little data available; initial visual inspection/weighting of recyclables to provide indicative daily data undertaken by SKM staff but access limited latterly	N/A	Daily data provided by machine supplier	Approximately four weekly provision of weekly data for relevant items sold in the restaurant and the Swedish Food Market by sustainability staff; data for store sales have been provided for PET and glass bottles	Approximately four weekly provision of weekly data for voucher redemption figures provided by sustainability staff	Some data on recyclables for a proportion of the trial period only	No data provided	4	Granular level telemetry data analysis	0	1	2	1 day per store		
	IKEA Glasgow	Monthly data for Britvic vending machine sales only	Monthly average residual waste data estimated based on volumes provided by store	N/A	Daily data provided by machine supplier	Approximately four weekly provision of weekly data for relevant items sold in the restaurant and the Swedish Food Market by sustainability staff; data for store sales have been provided for PET and glass bottles	Approximately four weekly provision of weekly data for voucher redemption figures provided by sustainability staff	Weekly residual data provided	No data provided	1	Granular level telemetry data analysis	0	1	2	1 day per store		
	Whitmuir	2012 unit sales provided for same period as pilot	Very little data available; initial visual inspection/estimation by volume of recycle and residual bins to provide indicative daily data undertaken by SKM staff; not possible to estimate fullness of glass banks (opaque)	N/A	Machine supplier provided at a weekly level	Weekly data provided by WO staff every few weeks	Machine supplier provided data on issued at a weekly level; weekly data on total redemptions provided by WO staff every few weeks	Weekly observations by WO staff of bags in the dry recyclables storage shed and residual bins where practicable	Machine supplier provided at a weekly level	1	N/A	0	1	0	Online - no target	Machine downtime data conflicting with staff experience due to issues with the quality of barcode stickers applied causing difficulty in machine reading	
Festival	HebCelt	None available	General waste and organics only for the 2012 festival	N/A	Machine supplier provided at a daily level	Hebcelt (beer cups; via Caroline) and 4 other vendors (bottles and cans); Based on stock purchased and left at end	Festival and machine supplier provided data on vouchers issued for prize winners	Council provided weighbridge data; supporting waste data gathered by SKM/Hebcelt team during festival via waste analyses	Manual observations only	Staff on-site the duration of entire festival	General waste analysis from litter pick / general waste	0	0	2	100		

Table A1 Breakdown of monitoring activity undertaken at each site



Zero Waste Scotland works with businesses, communities, individuals and local authorities to help them reduce waste, recycle more and use resources sustainably.

Find out more at zerowastescotland.org.uk
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