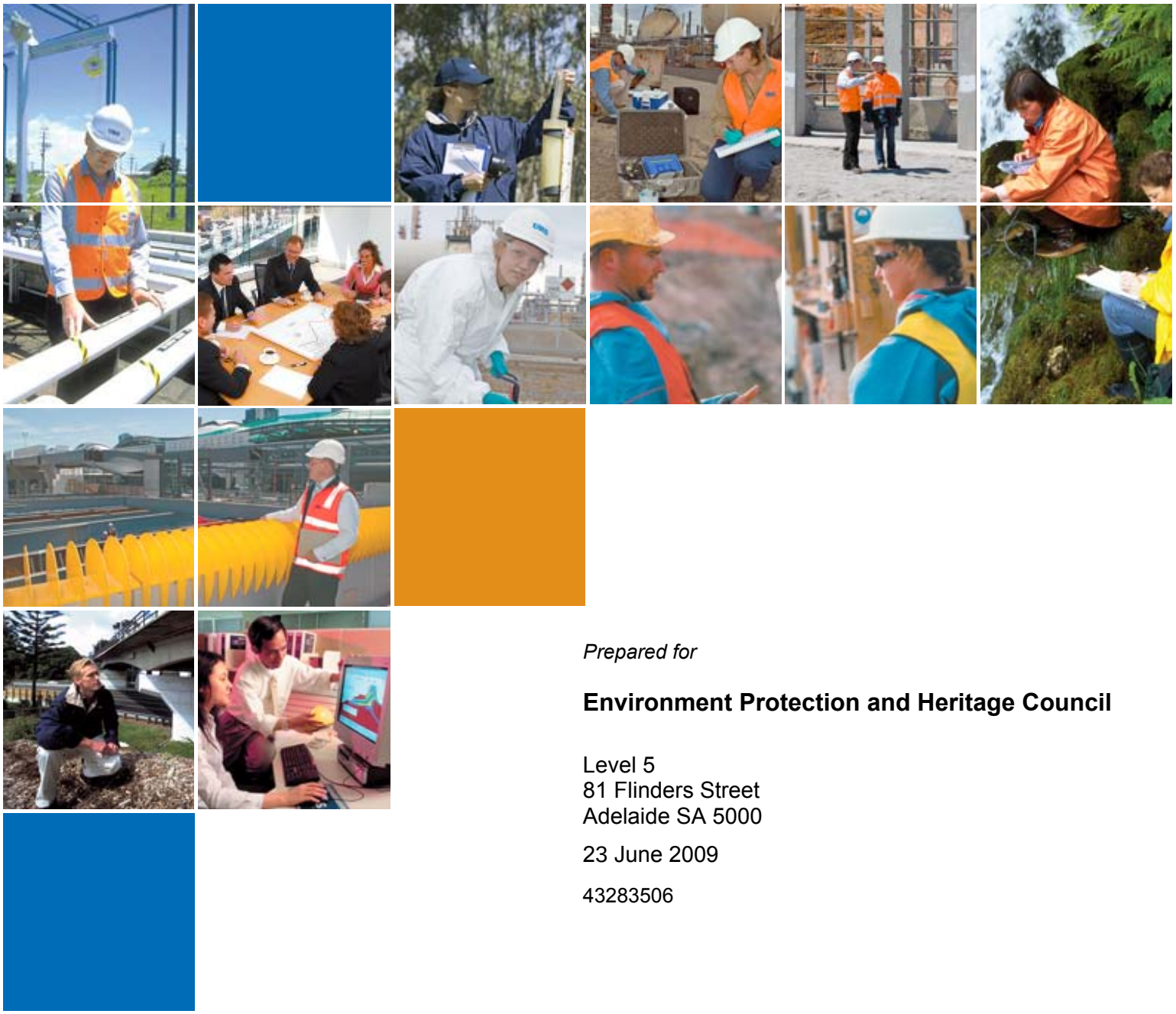
FINAL REPORT

Willingness To Pay for E-Waste Recycling



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Executive Summary

ES 1 Overview

Ownership of electronic items such as televisions and computers is rising rapidly, and with it, concerns around disposal of end-of-life items. There is widespread concern in the community (relayed by environmental NGOs) about sending so many electronic components (known as e-waste) to landfill when it could be seen as a valuable resource. Although e-waste constitutes a relatively small percentage of the waste going to landfill, it is somehow more "iconic" than other types of waste, as it is readily identifiable.

However, there is little incentive for businesses to provide e-waste recycling services, as the cost involved in collection and processing far outweighs the possible value of materials recovered. Given that community concern exists about the low level of recycling currently undertaken, this project's objective was to determine if that concern would translate into a willingness to pay (WTP) for higher levels of recycling achieved via government intervention.

ES 2 Methodology

ES 2.1 Approach and questionnaire design

The approach used in this study to estimate household WTP was Choice Modelling. This was the approach recommended by R & Z Consulting in a related preliminary study conducted in 2008 for the NSW Department of Environment and Climate Change (NSW DECC) and builds upon previous work conducted by NSW DECC and the Environment Protection and Heritage Council (EPHC).

Choice Modelling is a well-recognised technique to estimate the value of goods and services that are not traded on market and therefore have no "price" as such but are still valuable for the community. Choice Modelling is a survey technique whereby respondents are asked to select between different options presenting trade-offs between various attributes – in this case, respondents were asked to choose between recycling scheme scenarios with different levels of recycling, collection methods (kerbside/drop off) and cost (a levy per item purchased). These sets of scenarios to choose from are known as choice sets. Each scenario is designed so that although hypothetical, respondents would find it credible and so that they would believe that they would really have to pay for the scenario they select, should it be implemented. A statistical model is then developed to estimate the household WTP for a certain increase in recycling, and to understand how different variables affect WTP. The estimated individual WTP can then be aggregated to the whole of the population considered.

The robustness of such studies relies on the attention given to the framing of the questions and the representativeness of the sample of respondents. The sample size was defined to maximise the chances of achieving a high statistical level of confidence whilst minimising the total number of responses required. The initial questionnaire design for this study was refined with input from NSW DECC, EPHC, the Australian Bureau of Agriculture and Resource Economics (ABARE) and the Office of Best Practice Regulation (OBPR), to ensure that it met the standard for inclusion in the subsequent Regulatory Impact Statement. Six focus groups were held to test the questionnaire in Melbourne, Sydney, Adelaide and Brisbane, with comments incorporated into subsequent versions of the questionnaire. A key issue was the level of information provided to respondents – it was important that they had accurate information regarding e-waste issues so could make an informed choice, but not so much that it might bias the results, cause participants to become confused or lose interest. A lot of attention was given to the development of the choice modelling experiment in order to reduce the risk of respondents misunderstanding the questions put to them and therefore obtain skewed results. Focus groups produced fruitful insights into the level of information and the nature of information that respondents considered necessary and appropriate.

Executive Summary

ES 2.2 Survey implementation

A pilot survey of 305 participants was used to test the questionnaire online and refine the choice sets. The choice sets were randomised when administered online. Full questionnaire implementation occurred over three weeks in January 2009 with participants from Melbourne, Sydney, Adelaide, Perth and Brisbane, the five cities selected to obtain the best coverage for the survey given existing budget and time constraints. Online questionnaires were deemed necessary in order to reach the maximum number of participants within a short timeframe. Survey participants were recruited from an on-line panel of respondents who have all agreed to participate to on-line studies (pre-recruitment). In total, 2,623 questionnaires were received, of which 2,105 were deemed suitable for inclusion in the subsequent analysis (the remainder being incomplete or removed due to inadequate data quality). The use of quotas for age, gender and income assisted in ensuring that the survey sample was representative of the relevant city population as reflected in the 2006 Census data of the ABS (see below, Section ES 3.3).

ES 3 Findings

ES 3.1 Television and computer ownership

The sample population had high levels of television and computer ownership (99% had a television, and 92% had a computer). The average household had almost seven televisions, CPUs, monitors and/or laptops, and was expecting to purchase either or both a television and a computer in the next five years (average was 1.76 items).

The way the survey was administered (online) was expected to create a bias towards computer owners. To assess the significance of this bias, it was attempted to compare with existing computer and television ownership. However, the nearest comparable data is four years old (Ipsos 2005); this data indicated 99% of households had a television, but only two thirds had a computer. It also indicated a rapidly increasing trend towards computer ownership, which is consistent with the higher ownership numbers in the current study.

ES 3.2 Modelling results

The survey results were analysed using a statistical model (known as a Random Parameter Logit model) to calculate overall WTP for a recycling scheme and to identify which variables were contributing to an individual's WTP.[1] Models were developed for the full sample and for individual cities. For all models, the results are considered robust[2], indicating that there is little variation in WTP that is not explained by the model. For the full sample, all variables are statistically significant (gender, age, income, etcetera), and are signed as expected (income for example has a positive sign, indicating that as income rises, WTP rises). In general, WTP was found to be higher among younger people, women, the more educated and those with higher incomes. Results for individual cities do not vary significantly from the full sample.

To allow easy calculation, the WTP estimates were calculated per percentage increase in e-waste recycling over the current situation (1% only), bearing in mind that the minimum achieved percentage of recycling proposed to the respondents was 50%. Practically, this means that estimates should only be used for schemes achieving more than 50% of recycling of TVs and computers. Respondents were found to be on average willing

[1] This work was undertaken by ERE Consulting (led by Prof. Jeff Bennett).

[2] They all have an adjusted rho squared statistic greater than 0.35 and strong internal consistency.

to pay $0.50 per item per percentage point of increase in recycling (lower estimate of $0.43, upper estimate of $0.56). For an increase in the recycling rate to 50%, the average household would be willing to pay between $18 and $27 per item and between $33 and $50 for an increase to 90%. In addition to this, respondents were willing to pay $3.55 per item as a premium for having the items collected from the kerb rather than having to drop them off at a recycling facility.

These figures can be aggregated up to the whole population of the study's cities to calculate a total WTP. This aggregate figure takes into account the average number of items people expect to purchase in the next five years, the number of people who did not respond to the survey and were deemed not to be willing to pay anything, and the number of households in the respective cities.

Aggregating this to the whole of the study population (the households in Sydney, Melbourne, Adelaide, Perth and Brisbane), gives the following estimated total WTP (with a 95% confidence interval):

- For an increase in the recovery rate to 50 percent: $137.5 – $207.6 million;
- For an increase in the recovery rate to 70 percent: $193.7 - $292.3 million; and
- For an increase in the recovery rate to 90 percent: $249.8 - $377 million.

ES 3.3 Statistical validity

These results are considered to be very robust and provide a reliable estimate of the WTP to recycle TVs and computers in the five major cities included in the survey. The estimates were obtained using a methodology that minimised respondent bias as much as possible, ensured that respondents were informed but not overly so, and enhanced the probability of respondents answering honestly and accurately.

The survey population was also broadly representative of the population as a whole. This was assisted through the use of participant quotas for age, gender and income. As there was a small bias towards more educated/wealthier respondents, additional analysis was carried out to provide estimates of WTP specifically for these groups, which could be used in a sensitivity analysis.

The statistical models developed from their answers were internally consistent and were able to explain much of the variation in respondent WTP. The results obtained can be considered a valuable and reliable source of information to inform the making of policy decisions with respect to the management of e-waste, the potential need for government involvement and the undertaking of associated Regulatory Impact Statement.

Introduction Section 1

1.1 Context

Electronic devices such as televisions and computers are becoming increasingly common throughout Australia. It is estimated that the stock of electronic items in Australia amounts to 18 million televisions and 24 million computers. Disposals are 1.5 million and 2 million respectively each year (Refer Section 2.2.1).

There is widespread concern within the community over the appropriate disposal of unwanted electronic equipment, commonly referred to as e-waste (see for example, ABC 2008.) These concerns, which also exist in other countries, relate to:

- the volume of these items in landfill and resultant unnecessary use of landfill space;
- the loss of scarce resources embodied in the items; and
- the risks to human health and the environment because of the potential hazardous nature of e-waste.

E-waste can be recycled, with a high proportion of the materials able to be recovered. However, there are a number of issues associated with the collection and recycling of such wastes which manifest themselves in a very small proportion being recycled (estimated at 1 per cent, as far as household e-waste is concerned). A major reason is that the value of the recovered materials is less than the cost of collecting and processing e-waste. Thus there is very little incentive for private companies to offer recycling services.

This project for the Environment Protection and Heritage Council (EPHC) arose from the community concerns mentioned above that the level of recycling is too low and that too much e-waste is disposed to landfill. In essence, the project's objective is to verify whether people's concern would translate into their being willing to pay an amount to achieve a higher level of recycling than that achieved at present.

An individual's WTP for recycling is an indication of the increase in wellbeing they would obtain from a change in recycling. It can be estimated by using economic techniques such as choice modelling. This technique involves surveying a sample of the wider community using a questionnaire which includes a set of choices involving trade-offs between various attributes, one of which is the cost of a possible recycling scheme.

The estimates thus attained can be combined with other market determined costs and benefits to help determine whether regulatory action is required by governments to achieve higher levels of e-waste recycling. Previous efforts, mainly by the New South Wales Department of Environment and Climate Change (NSW DECC), to implement voluntary industry arrangements to manage e-waste pointed towards the need for regulatory support.

The comprehensive assessment of the costs and benefits of establishing an e-waste recycling scheme and the necessary regulatory environment will be the subject of a companion project that involves the preparation of Consultation Regulatory Impact Statement (RIS) in accordance with the Best Practice Regulation Guidelines of the Council of Australian Governments (CoAG). The results of this study, therefore, form an important input into the preparation of the RIS.

1.2 Team

A multi-skilled specialist team worked collaboratively to complete this project. This included economics and statistics analysts from ERE Consulting, market research specialists from NWC Research, and policy and economic analysis specialists from URS.

1.3 Report structure

This document reports the results of the choice modelling survey and is structured as follows. Section 2 summarises the background of the project and its policy environment. Section 3 details the methodology and techniques used. Section 4 presents the results of the survey and the analysis, and Section 5 delivers a short conclusion.

Section 2 Background

2.1 Policy environment

2.1.1 In Australia

Under the Australian Constitution, responsibility for managing wastes, including e-wastes, rests largely with the States and Territories. Local governments are active providers of waste management services within the policy and regulatory frameworks established by their respective State/Territory. The role of the Commonwealth Government is limited to international arrangements affecting waste management and to facilitating a coordinated approach by the States and Territories towards the management of waste, including the meeting of best practice regulation requirements of CoAG; the direct involvement of the Commonwealth may also be required if the taxation powers of the Commonwealth are required to implement a regulatory approach. As illustrated through this project, a coordinated approach to waste by Australian jurisdictions is achieved through the EPHC.

From an international perspective, Australia is a signatory to the *Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and Their Disposal*. Under this Convention, because certain components of televisions and computers are classified as hazardous, e-waste cannot be exported from Australia without a permit.

2.1.2 International context

Concern about e-waste in the European Union has led to the introduction of regulation by member states and two European directives, namely the "EU Waste electrical and electronic equipment (WEEE)" and the "Restriction of Hazardous Substances (RoHS)" directives. The first covers both obligatory recycling schemes and waste reduction strategies, whilst the second regulates the use of particular toxic substances (such as lead, mercury, cadmium, and hexavalent chromium) in electrical and electronic goods. It must be noted that, across Europe, waste is often incinerated and landfill space is at a premium, therefore the context is significantly different to the Australian context.

Regulations with similar objectives exist or are currently being developed across the United States of America and Canada (on a state by state basis). Japan has a Home Appliance Recycling Law which promotes product stewardship.

2.2 Previous initiatives and studies

2.2.1 Electronic waste and recycling

Electronic waste volumes

The NSW DECC has worked collaboratively with the EPHC on the possibility of developing voluntary product stewardship initiatives for televisions with the peak electrical and electronic industry associations, namely the Australian Electrical and Electronic Manufacturers Association (AEEMA), Consumer Electronic Suppliers Association (CESA), and the Australian Information Industry Association (AIIA). NSW DECC also commissioned a Household Electrical & Electronic Waste Survey in 2005 (Ipsos 2005). The information attained through these two initiatives was used to inform the survey design and questionnaire for this project. This, and other information provided by NSW DECC to inform the study, is considered to be the best available data at the present time. The data is currently being updated by NSW DECC and may therefore vary from the data used in the study.

Table 2-1 shows estimates of existing stocks and disposal volumes for televisions and computers in Australia. At present, only around 7 percent of computers and a negligible number of televisions are recycled and this includes recycling of business computers. Overall, it has been estimated by NSW DECC that only about 1% of all households' computers and televisions are currently recycled. This figure has been used as the baseline for the status quo scenario in the main Choice Modelling survey.

Table 2-1 End of life televisions and computers - national figures

	Televisions	Computers
National stock (units)	18 million	24 million
Estimated disposal to landfill/year (tonnes)	1.5 million	2 million
Estimated annual tonnage to landfill	40,000	38,000
Estimated national recycling rates	Negligible	7%

Source: ABS and NSW DECC modelling

Recycling process

Whilst the recycling of e-waste is generally seen as desirable by consumers, there are a number of barriers that have impacted on the establishment of a comprehensive recycling system to date. These include difficulties in the separation of electronic components and in establishing broad-scale collection systems. Combined, these difficulties mean that the recycling of e-waste is generally not of commercial viability.

Many of the components that can be recycled from e-waste have a very low resale value which does not cover the cost involved in collecting and processing the item. Based on a pilot program in Melbourne in 2001-02, for example, the total cost (net of revenue from the sale of recycled components) was estimated at $22 per television (Nolan-ITU 2004). Moreover, the recycling industry, similarly to primary industries, is exposed to commodity price variations. These costs and uncertainties reduce the commercial opportunities for companies to enter the market unless recycling costs can be recovered from the consumers, or the wider community. Some companies, such as Dell, offer free recycling to Dell-brand computers, but charge a fee to recycle other brands.

Potential environmental impacts

In 2007, the NSW DECC commissioned a study to determine the environmental benefits of recycling end of life televisions (Hyder 2007) and carried out research to better understand the opportunity for resource recovery from recycling televisions and computers. Table 2-2 and Table 2-3 summarise the findings of this research, which has been used in a simplified form in the survey.

From an environmental impact point of view, the key difference is whether the computer or TV screen is of the flat-screen type or cathode ray tube (CRT) type. However, in general, households do not see a distinction between televisions and computers, as their functions tend to overlap more and more and the materials used are very similar. The major difference, from the respondents' perspective, is in terms of size – large flat screen televisions being much more difficult to handle and transport than computers[3].

[3] Results from the focus groups conducted as part of this study.

Section 2 Background

Table 2-2 Material composition of average cathode ray tube (CRT) and flat panel display (FPD) televisions

Material	CRT (grams)	%	FPD (grams)	%
Glass	17,802	67%	6,273	22%
Plastic	4,867	18%	8,594	30%
Copper	971	4%	824	3%
Iron	594	2%	4,127	15%
Aluminium	225	1%	1,776	6%
Steel / other metals	93	0%	5,923	21%
Other	2,118	8%	784	3%
TOTAL	**26,670**	**100%**	**28,301**	**100%**

Source: United Nations University (2007)

Table 2-3 Hazardous substances in televisions and computers (based on average unit size)

Substance	Television CRT (grams)	Computer CRT Monitor (grams)
Lead	1,787.57	786.04
Bromine	20.40	3.97
Zinc	6.41	25.9
Antimony	5.75	3.02
Chlorine	3.78	n/a
Chromium	3.75	3.78
TOTAL	**1,827.66**	**796.81**

Source: United Nations University (2007)

As the risks of health and environmental damage from landfills are difficult to assess and open to controversy, and considering that landfill space in Australia is probably less constrained than in other countries (although this may be a matter of judgment), no information on landfill risks was sought through the choice modelling questionnaire.

2.2.2 Economics

In responding to the concerns by the wider community noted above about the low level of recycling of end of life televisions and computers, it is necessary to consider the costs and benefits of doing so before setting recycling targets. If achieved, such targets could result in greater costs being incurred by the wider community, compared with disposal through other means. These considerations led to a review of waste management strategies by the Productivity Commission (PC) in 2006. In its Final Report, the PC states that: “State and territory waste management policies contain some inappropriate and inconsistent objectives. These have led to some jurisdictions adopting unrealistic, and potentially very costly, waste minimisation targets” (Productivity Commission 2006).

The findings of the inquiry by the PC and the principles of CoAG (mentioned above) have guided the EPHC investigations into economic evaluation techniques which would be most appropriate to inform a benefit-cost analysis[4] as part of a RIS for recycling e-waste. While market prices may be used to estimate most costs and market benefits relating to e-waste recycling, market prices do not capture likely non-market welfare values[5], namely, the gain (or loss) of wellbeing that people derive from the knowledge that waste is avoided and material recovery is achieved through recycling (refer Section 1.1).

In addition to a review of international studies on the topic (RMIT 2006), two studies were specifically commissioned by NSW DECC to gain a better understanding of how best to address the concerns of the wider community with respect to e-waste and the findings of the PC. The first study sought to define the economic analysis framework which would best accommodate non-market benefits (R&Z Consulting 2008a); and the second looked specifically at the suitability of stated preference techniques to estimate quantitatively the consumers' Willingness-To-Pay (WTP) for recycling electronic goods. This study concluded that Choice Modelling would probably provide the best outcome, as it is better able to deal with a more complex policy scenario, and can provide more insight into trade-offs people are willing to make.

These two studies led to the definition of the scope and the commissioning of the present project by the EPHC.

2.3 Contribution to future policy development

The objective of this project is to provide estimates of non-market values associated with e-waste recycling, and in particular, values that are widely accepted as being robust and suitable to assist in the preparation of a Consultation RIS. Such estimates provide an appropriate measure of the market failure or a measure of the loss of welfare resulting from the current low level of e-waste recycling (R&Z Consulting 2008b).

The estimates derived from the modelling can therefore be used to inform a subsequent benefit-cost analysis and help identify the preferred policy option for managing e-waste, provided the link between each policy option and the likely percentage of waste avoidance and resource recovery can be adequately established. As described in Section 3.3, the questionnaire was designed to capture only non-market values and the wellbeing derived by individual households from these values through recycling (as opposed to the market value of recovered material for example). Nevertheless, due consideration to potential double-counting will be required in undertaking the benefit-cost analysis for the Consultation RIS to avoid the potential for confusion between market and non-market values, depending on how the benefit-cost analysis is structured.

As discussed further in Section 3, other questions were asked in the questionnaire to attain insights into current ownership of televisions and computer equipment, and attitudes to recycling (qualitative assessment). The responses obtained provide context to the WTP estimates derived; they also provide an opportunity for the EPHC to compare household equipment data with similar data obtained from previous study (Ipsos 2005).

[4] A framework for bringing together all the costs and benefits of an action once expressed in monetary values.

[5] Non-market values being those benefits (or costs) which individuals derive from goods that are not traded in a market, such as smog, health impacts, green grass, comfort, convenience, etcetera.

Section 3 Methodology

3.1 Introduction

The methodology used in this study builds upon previous work conducted by EPHC, NSW DECC and R & Z Consulting (2008a and 2008b) who have outlined the issue at hand, identified a suitable approach (choice modelling), and made significant progress towards defining the attributes of the choice set.

This section describes the methodological approach used to estimate the willingness of people to pay for the non-market values associated with recycling end of life televisions and computers — the approach adopted and its application were developed in close consultation with the project Steering Committee. Specifically, the section details:

- how the survey sample was defined;
- how the questionnaire was developed;
- the experimental design used for the Choice Modelling survey;
- how the field survey was conducted; and
- the statistical principles used in the analysis.

A schematic summary of the methodology's key steps is provided in Figure 3-1.

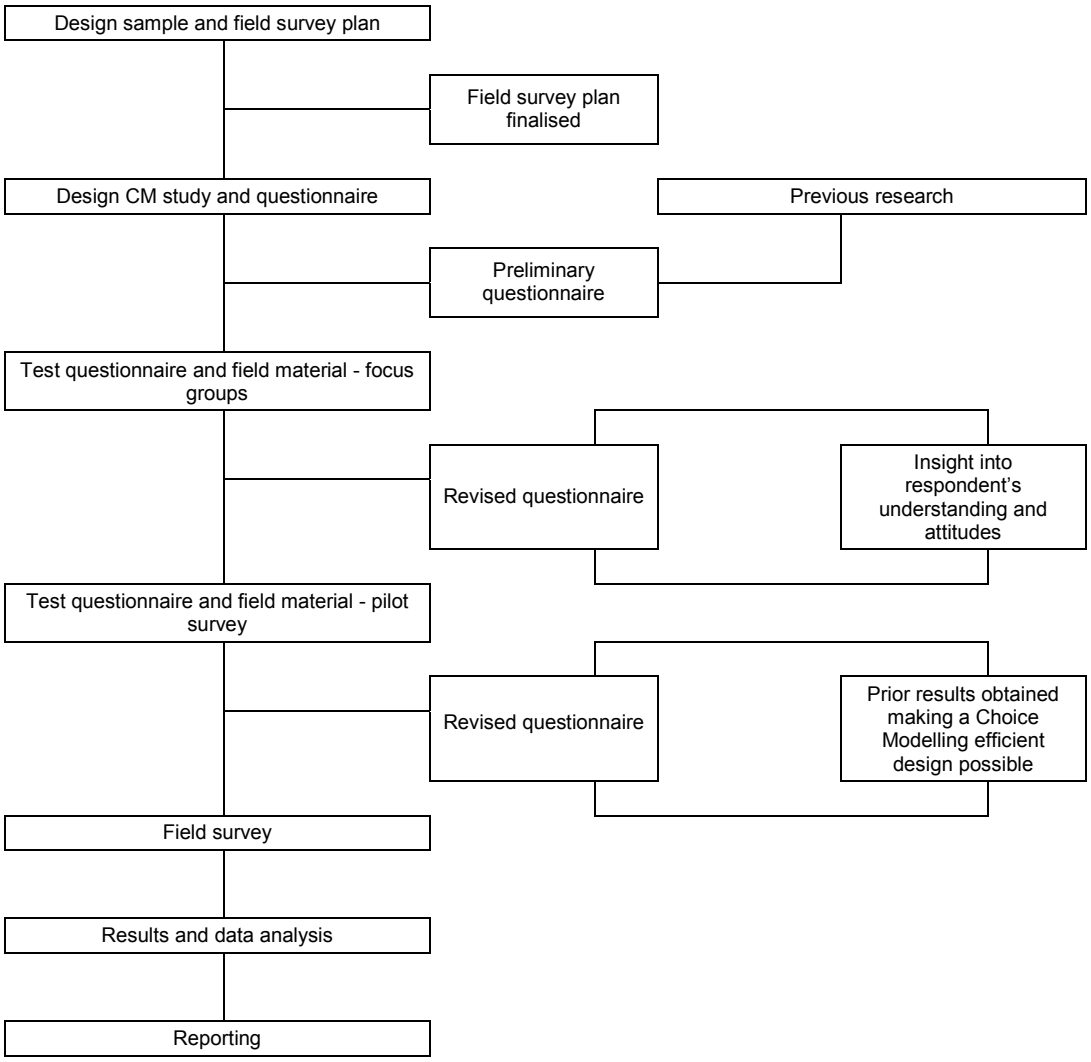

Figure 3-1 Methodology summary

3.2 Survey scope, sample and technique

3.2.1 Scope of the survey

While it is recognised that e-waste is an issue at the national level, time and budget constraints required some trade-offs to be made regarding the survey coverage. For example, a minimum sample from each location has to be obtained to ensure a satisfactory statistical confidence for that location, which makes the selection of smaller cities less cost-efficient. It would also be very difficult to generalise results obtained from specific non-metropolitan areas, as there is no indication that they would be representative of the population of other non-metropolitan areas. Finally, as a majority of the Australian households live in capital cities, it was assessed, in consultation with the Steering Committee, that the best coverage (within the budget and time constraints) would be obtained by focussing on the major capital cities – Sydney, Melbourne, Perth, Brisbane and Adelaide. This would also allow the identification of statistically significant differences in behavioural patterns, if any.

Section 3 Methodology

3.2.2 Panel characteristics

The survey was implemented using an online panel managed by Survey Sampling International, commissioned by NWC Research. This panel has been pre-selected to be representative of the Australian population as a whole.

The choice of an online panel of respondents as a survey method was driven by cost and timing considerations and was also considered appropriate in the light of the nature of the underlying good which was being discussed (e-waste). This mode of survey has the advantage of allowing a large number of respondents to be reached within a very limited timeframe. This choice had some positive practical implications on the way the questionnaire was developed, in particular it allowed for easy rotation of choice sets within each Choice Modelling block (see section 3.4 for details on the choice modelling methodology).

Questions were framed such that the respondent answered the survey questions on behalf of the household as a whole. Respondents had to be over eighteen years of age, and the majority were in the workforce/retired, suggesting that very few would not be in a position to answer on behalf of the household or even make investment decisions themselves about the investment.

3.2.3 Sample size

The sample size was chosen to maximise the chances of achieving a high statistical level of confidence whilst minimising the total number of responses required (verified by the tight confidence interval around the results analysed in Section 4).

The following table illustrates the sample sizes chosen for the different cities, and the actual sample size achieved after elimination of non-valid questionnaires.

Table 3-1 Survey sample sizes

City	Sample size	Sample size achieved
Sydney	600	588
Melbourne	600	600
Perth	300	305
Brisbane	300	307
Adelaide	300	305
Total	2,100	2,105

3.2.4 Quotas

In addition to the sample sizes chosen for each city, additional quotas were set for the main survey, to ensure adequate representation from across the different strata of society. Given the small sample size, quotas can be an effective way of ensuring that the survey results are broadly representative of the population as a whole. Quotas were set based on age, gender and income level. Individuals fitting within the quotas were identified by screening questions at the beginning of the survey.

The specific quotas, and the actual number of responses achieved, are listed in Appendix B. On the whole, the achievement of quotas was considered as satisfactory. The quota for high income males aged 35-44 achieved the lowest fill rate (87 percent), which still ensures a good representation of this group of the population. As deviations from the quotas were only minor, they are not expected to negatively impact on survey validity, which shows a strong internal validity. The important element is that the structure of the sample should be close enough to the structure of the overall population: on this point, see 4.3.1 and Appendix D.

3.3 Questionnaire development

The questionnaire was developed following an iterative process involving a number of steps, as indicated in Figure 3-1.

3.3.1 Process

Pre-testing of the questionnaire occurred through focus groups and a pilot survey, allowing for the development of an efficient experimental design for the main survey. The paragraphs below describe these steps in more detail and the next section expands on experimental design.

A summary of the structure and information contained in the questionnaire is provided in Table 3-2.The final questionnaire is provided in Appendix A.

Table 3-2 Mapping of survey questionnaire

Categories of questions	Content	
Demographic Q 1 – 4 and Q27 – 29	Gender Age Postcode Household income Type of household, e.g. single, family Type of dwelling Level of education	
Attitudes to waste Q5 – 10	Waste management behaviour Attitude to potential issues associated with household waste Attitude to recycling	
Television and computer ownership Q11 – 17	How many televisions and computers does your household own? How many worn out televisions and computers have you disposed of in the last two years? How did you dispose of it/them? In the next five years, how many new televisions and computers do you expect your household to buy?	
Choice modelling Q18 – 23	**Attribute**	**Level**
	Collection method	Kerb-side, Drop-off, current method
	Percentage of waste avoided and material recovered	50%, 70%, 90%, 1% (current)
	Additional cost on each new television / computer purchased	10$, 20$, 40$, 60$. 0$ (current)
Follow-up questions Q24 – 26: About choice modelling responses Q30 – 32: About the survey	What did you chose and why? How did you find the survey and any other comments	

Section 3 Methodology

3.3.2 Initial questionnaire

Framing information

The development of the online questionnaire was a collaborative effort involving input from previous work undertaken or commissioned by EPHC and NSW DECC and drawing on experience in survey design from similar work. Specifically, most of the information on waste in general and e-waste in particular came from information collected by NSW DECC, including information on likely approximate cost per item for recycling schemes (which translated into the levels for the cost attribute).

Comments were sought from the Office of Best Practice Regulation (OBPR) and the Australian Bureau of Agriculture and Resource Economics (ABARE) regarding key principles and requirements. These were then integrated into the survey methodology. The OBPR was involved early to ensure that the WTP estimates could be incorporated in the assessment of the cost and benefits in the development of the Consultation RIS.

Key issues discussed included the level and the nature of information which should be provided to respondents, so that they could make an informed choice but not be "over-informed". This meant that they could still be considered as representative of the population as a whole. Over-informing respondents can lead to over-emphasising the importance of an issue in the mind of the respondent, which in turn is likely to lead to an over-estimation of the WTP.

In the end, the information presented was kept as factual as possible, and controversial or ambiguous information was left out such as information on risks in landfill. Human and environmental risks relating to landfills (and the substances that are deposited in those landfills) were considered controversial, as expert opinion differs as to whether the risk is virtually nonexistent or significant, especially bearing in mind that landfills could be mismanaged over time. Providing a lengthy discussion of the pros and the cons would potentially confuse respondents or cause them to lose interest, therefore the decision was made to leave any landfill risk information out of the survey. Too much or too complex information in a survey creates a bias towards over-informed or over-committed people, and is not generally considered good practice. It is essential to stress one important consideration which is the time limit of the survey, as respondents are unlikely to be able and willing to dedicate more than about 15 minutes to such surveys. The relevance and adequacy of the content and the format of the information presented was tested and validated through focus groups (see below).

Payment scenario

The payment scenario is also an important element of the questionnaire and this was also discussed during the focus groups (see below). To ensure the WTP experiment is valid, respondents must be convinced that they actually will have to pay the amount stated in the Choice Modelling questions. In this survey, this was pursued in three ways: first, the payment mechanism selected was believable (a product levy) and discussions in the focus groups demonstrated that people believed that they would have to pay the levy; second, warnings were introduced in the questionnaire just before the Choice Modelling questions (urging people to consider their financial constraints); thirdly, choice modelling data from people who stated that they did not believe that they would really have to pay were subsequently analysed to see if their WTP was different to the other respondents (which was found not to be the case).

Questions in the Choice Modelling survey were also carefully debated and the Steering Committee requested some questions be asked, in order to complement previous research undertaken. However, the main objective of the questions preceding the Choice Modelling scenarios was to "frame" the issue in the respondents' minds, i.e. to lead them progressively to think about waste and recycling, then about electronic equipment in their household and the issue of its end-of-life disposal.

3.4 Choice modelling experimental design

3.4.1 Principles of experimental design

Choice modelling involves survey respondents being presented with numerous choice options regarding the future (in this case, future policy options regarding e-waste recycling). The choices made by respondents provide insights into people's preferences for the various outcomes and the trade-offs between the various attributes of the scenarios presented. To explore these preferences in a systematic way, the choices provided to survey respondents in a choice modelling questionnaire are structured into an "experimental design" that combines varying attributes into options and then options into choice sets which involve trade-offs (refer to questions 18-23 in the questionnaire).

The experimental design, ideally, would present respondents with all the possible combinations of attribute levels. Usually however, this is not feasible as the large number of choice sets created would present an intolerable burden for most people. The experimental design is therefore split into manageable "blocks" which are presented to different respondents (assuming that, statistically, each sub-sample of respondents will have the same choice behaviour). In this case, six choice sets were presented to each respondent, and respondents were asked to consider each choice set independently. This independence of responses between choice sets was helped by the fact that respondents could not physically go back to the preceding choice set when filling in the survey online.

Each choice set contained three options, namely the "no change" option and two "change" options. Under the two change options, respondents were presented with a proposed benefit in terms of additional recycling of e-waste, a method for collecting the waste and a corresponding cost.

3.4.2 Experimental design for the pilot

For the pilot survey, the choice set options relating to possible future policy options were constructed according to a random experimental design. In other words, the levels used in each of these "change" options were randomly assigned to the attributes. As mentioned above, the "status quo" or "no change" option was included into each choice set.

The attributes and their levels were:

	Change options	No change option
Collection Method	Kerbside, Drop-off, call-up	Current method
Recovery of Material	50%, 70%, or 90%;	7%[6]
Additional cost per item purchased	$10, $20, $40, or $60.	$0

To ensure the statistical significance of the estimates derived, 24 choice sets were created[7]. The random design was checked for redundancy and dominance of choice sets. Dominant and random choice sets were eliminated by swapping attribute levels.

[6] This level was subsequently changed to 1% for the main survey, as it was found to be over-estimated only after the pilot survey had been launched.

[7] Based on experimental design literature, the smallest number of choice sets would be twelve in order to maintain a balance across attribute levels and to be able to account for interaction effects in the analysis.

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To keep the questionnaire within respondents' tolerance thresholds, the 24 choice sets were divided into four blocks of six each. Hence, each respondent was asked to make six choices. The full experimental design was therefore completed by randomly submitting the blocks to four sub-samples of respondents.

3.4.3 Efficient experimental design using pilot priors

Summary

Based on the results of the pilot survey (see 3.5.2), a new design was created for the main survey. As it was noted that the collection methods "call up" and "kerbside" were not different enough from each other to make a difference for the respondents, the "call up" level was abandoned. This allowed the reduction of the number of possible combinations. However, the key step in the building of the new experimental design was to use a statistical method to reduce the number of choice sets while maintaining a good "efficiency" of the model, i.e. preserving the capacity to derive statistically significant WTP estimates. This led to an experimental design with only two blocks of six choice modelling questions. The full experimental design could therefore be completed by randomly submitting the blocks to only two sub-samples of respondents. More detail is provided below.

Detailed statistical method

For the main survey, a statistically D-efficient design was created to provide the structure of the choice sets. Statistically efficient designs aim to maximize the amount of information obtained from a single choice experiment. One commonly used approach to achieve design efficiency is to maximize the determinant of the variance-covariance matrix (otherwise known as the Fisher information matrix) of the model to be estimated. The global level of efficiency can be measured by the D-error, which minimizes the determinant of the inverse Fisher information matrix:

$$\text{D-error} = (\det \Omega^{-1})^{1/K},$$

where K is the total number of generic parameters to be estimated.

Selecting an experimental design with the lowest D-error will yield the smallest possible standard errors around the parameters to be estimated. The smaller the D-error, the more statistically efficient is the design for a given sample size.

The statistical efficiency of an experimental design depends on the design dimensions (such as number of attributes, number of attribute levels, number of choice options, number of choice sets), the number of respondents and the parameter values of the attributes. That is, in order to calculate a statistically efficient experimental design, information on all these factors is needed. Most problematic are the parameter values for the attributes that are used to describe the choice options. Since the true values of the parameters are not known before the questionnaire is administered, estimates of the parameters retrieved in the pilot study were used in the efficient design process.

The D-efficient experimental design used for the main survey was developed with attributes:

- Collection Method: current collection method, drop-off, kerbside.
- Recovery of Material: 1%, 50%, 70%, 90%.
- Cost: $0, $10, $20, $40, $60.

In order to maintain a balance across attributes and be able to account for interaction effects in the analysis, the smallest possible number of choice sets in an efficient design is twelve[8]. The D-error of 500 randomly selected designs was calculated using the priors obtained from the pilot study for cost (-0.03) and material recovery (0.01). Since the definition of the attribute "Collection Method" was changed after the pilot study (the attribute level "call-up" was eliminated and the remaining two levels "kerbside" and '"drop-off" were defined slightly differently), the prior for this attribute was set to zero.

The most efficient design had five dominant and one redundant choice set. After accounting for redundancy and dominance through the swapping of attribute levels, the D-efficiency of the design was about seven per cent lower than the highest possible theoretical efficiency.

As shown in Table 3-3, the twelve choice sets were divided in two blocks of six each to ensure respondent tolerance.

Table 3-3 Choice sets

Version A				Version B			
Choice set	**Cost ($)**	**% recycling**	**Collection method**	**Choice set**	**Cost ($)**	**% recycling**	**Collection method**
9	40	90	Kerbside	2	10	70	Drop-off
9	20	50	Drop-off	2	10	50	Kerbside
9	0	1	None	2	0	1	None
3	20	90	Kerbside	5	10	50	Drop-off
3	10	50	Kerbside	5	60	90	Drop-off
3	0	1	None	5	0	1	None
4	20	90	Drop-off	8	20	90	Drop-off
4	40	70	Kerbside	8	20	50	Kerbside
4	0	1	None	8	0	1	None
6	40	50	Kerbside	12	60	70	Kerbside
6	60	90	Drop-off	12	40	70	Drop-off
6	0	1	None	12	0	1	None
7	60	50	Kerbside	10	60	70	Kerbside
7	60	70	Drop-off	10	20	90	Drop-off
7	0	1	None	10	0	1	None
1	40	70	Drop-off	11	10	90	Drop-off
1	10	50	Kerbside	11	40	70	Kerbside
1	0	1	None	11	0	1	None

[8] As per choice modelling literature.

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3.5 Field work

The field work comprised three phases:

1) the focus groups, required to develop a good quality questionnaire;

2) the pilot survey - its main objectives were to test the validity of the experimental design in "real life" and obtain prior results in order to make the experimental design more efficient (as explained above), as well as to iron out any logistical and technical difficulties; and

3) the main survey - its objective was to collect statistically valid data required for the estimation of the WTP.

3.5.1 Focus groups

Focus groups were held in Melbourne and Sydney (two each), as well as Adelaide and Brisbane (one each) to refine the questionnaire. Each focus group lasted for 2 hours and was attended by between 5 and 10 people. Each focus group was facilitated by experienced professionals within the project team. The structure of the focus group allowed for initial facilitated discussion of participants' knowledge and attitudes towards recycling in general, and e-waste recycling in particular. This was followed by each participant completing the draft questionnaire.

A structured debriefing session was then held to assess:

- How well people understood the information provided and the questions asked;
- Whether they understood the choice sets and considered them to be realistic options, especially with regard to the level of attributes; and
- How they reacted to the format of the questionnaire (although, for practical reasons, the questionnaire was distributed on paper and not on screen, which required some minor adjustments).

After each focus group, comments were incorporated into a new version of the questionnaire which was then presented to the subsequent focus group.

Findings from the focus groups

There was a broad range of comments and opinions raised during the focus groups in relation to recycling and the recycling of e-waste in particular. Knowledge about the process and the cost involved varied significantly, but almost unanimously, participants considered that they were being either ill-informed or even misinformed about recycling. Of particular concern to them was the fact that waste might be collected for recycling by the council but still end up in landfill. Most expressed a strong commitment to waste avoidance in general.

Focus groups were broadly supportive of the idea of an e-waste recycling scheme, however raised concerns regarding the cost and convenience of such a scheme. In general, a user-pays approach was supported, although there was some argument that more should be done to encourage manufacturers to take responsibility for their products. There was broad support for some kind of product levy (the mobile phone recycling scheme, MobileMuster, was raised as a good example on several occasions), with a levy proportional to the price of the good purchased. A levy at disposal was widely considered as encouraging dumping and participants were generally anxious to avoid any kind of "free-riding" behaviour (such as somehow avoiding the payment of the levy), as well as any arrangement involving ongoing paperwork. It appeared that focus group participants were quite convinced that the scenario proposed would result in some payment from them as buyers of electronic goods. While the frequency of collection for e-waste was not mentioned as a key element of the scheme, it was generally assumed that, should a kerbside collection system be put in place, a quarterly or half-yearly collection would be adequate. Some called for this to be complemented by drop-off centres to cater for those who cannot store their used computers and televisions until the next collection.

A more detailed summary of the topics discussed and questions raised during the focus groups is shown in Appendix C. Key changes made to the survey as a result of the focus groups related to:

- the number of attributes: the attribute 'type of payment mechanism' had to be removed as too complex for people to grasp;
- the streamlining of information provided;
- the vocabulary used in the questions and information sections, which was found to be sometimes ambiguous, sometimes too complex.

3.5.2 Pilot survey

A pilot survey was conducted to trial the questionnaire before its release. 305 participants from 3 cities completed the questionnaire in the same online format that would be used in the final survey. Table 3-4 illustrates the breakdown of pilot survey respondents by city.

Table 3-4 Pilot survey respondents

City	Number of survey respondents
Brisbane	105
Perth	98
Sydney	102
Total	**305**

It should be noted that the pilot survey results were analysed mainly to obtain information to improve experimental design efficiency (priors), as described in section 3.4.3. It also served as a real life experiment for the rolling-out of the main survey. The results were used as a benchmark for the control of the main survey results but were not aggregated with the main survey results.

3.5.3 Main survey

The main survey was used to collect substantive information for the analysis described below. It was rolled out over a period of about three weeks in January 2009 by SSI.

Panel members were invited to participate in the survey through an email link. As key demographic characteristics of the panel members are stored by SSI, invitations targeting specific categories could be sent in order to manage quotas (city of residence, age, gender, household income). In total, 2,623 completed questionnaires were obtained (but some had to be rejected on the basis of quality).

Comparison between panellists who participated and those who did not participate in the survey

24,508 people were invited to participate in the survey. Of these, 4,567 accepted the invitation, but some of them were not selected as they did not meet the criteria or belong to a category already over quota. After eliminating non valid responses, the sample was trimmed down to 2,105 respondents. Those invited who did not participate in the survey did not necessarily decline to do so: it might have been that they did not see the survey in time or set it aside to respond later. It is not possible to obtain information on their motivation.

In order to assess whether there were any significant differences between those who chose to participate and those who were invited but did not participate, SSI provided the demographic characteristics of all panel members invited to participate, for comparison. As age, gender, and income were managed through quotas to ensure participants were representative of their respective city populations, those statistics have not been reproduced here. Employment and education was not managed through quotas and the comparison is provided in Table 3-5 and Table 3-6 below.

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Table 3-5 Employment status panellists (comparison)

Employment status	Survey respondents	Other invitees
Employed full time	44.5%	50.2%
Employed part-time (less than 32 hours)	17.5%	17.5%
Not working/looking for work	5.3%	7.1%
Not in the labour force	32.8%	25.2%

Table 3-6 Education levels panellists (comparison)

Education	Survey respondents	Other invitees
Bachelor's degree	18.9%	19.8%
Doctorate	0.7%	1.0%
High school	37.4%	39.3%
Master's degree	4.8%	5.0%
Primary school	6.6%	4.1%
TAFE/Diploma	31.6%	30.2%
Not answered		0.6%

As these two tables demonstrate, there is minimal discrepancy between those invited who responded to the survey and those who did not, in terms of education and labour force status. The only significant difference in proportions occurs with respect to labour force status, where the 'not in the labour force' category is higher for survey respondents than for the non-respondents. As a consequence, the 'employed full time' category is lower for survey respondents than for non-respondents. To assess whether there was a self-selecting bias amongst the respondents, these figures were compared with ABS figures. ABS labour force statistics for the survey cities reveal that the survey respondents' statistics are in fact more closely aligned with the ABS figures than the non-respondents (35.6% not in the labour force (ABS) compared with 32.8% (survey population)). As a given quota of respondents aged over 55 needed to be attained to meet age representativeness, the proportion of retirees (falling in the "not in the labour force" category) followed suit.

3.5.4 Data analysis

Summary

The data collected from the on-line survey were observations of respondents' choices between the various e-waste recycling options presented. These observations were linked to the respondents' socio economic characteristics as well as the levels taken by the recycling option attributes in each option.

As various levels of recycling have been tested as part of the choice modelling exercise, the WTP for recycling schemes achieving different levels of waste avoidance and resource recovery can be calculated, provided it remains within the boundaries of the percentages of waste avoidance and resource recovery tested in the survey. Corresponding confidence intervals have also been provided and, in addition to demonstrating the robustness of the results, may be used for uncertainty analysis. Similarly, the influence of the mode of e-waste collection on the WTP was also tested as part of the study.

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The first step of the analysis was to build a model with a high degree of internal consistency, i.e. a model that produces results that can be explained logically and do not contradict each other and with statistical indicators at a satisfactory level. The second objective of the model is to calculate estimates of WTP, with corresponding levels of confidence. More detail on the methodology is provided below.

It is important to note that WTP estimates should only be used for recycling schemes delivering more than 50% of recycling: under this threshold, no WTP can be assumed, as such scenarios were not represented in the survey.

Methodological details

The goal of the data analysis was to understand the relationship between the probability of a respondent making a specific recycling option choice and the levels of the option attributes and their socio-economic characteristics.

P (x|c) = f (A, S)

where P (x|c) is the probability of choosing option x from a choice set c;

f is a functional relationship;

A is the set of option attribute levels (recovery rate, collection method, cost); and

S is the set of respondent socio-economic characteristic scores (income, age, gender, etc).

The expectation is that choices with more of option attributes (A) that are valuable to respondents will be chosen more frequently and vice versa. Hence, we expect that the sign of the recovery rate attribute co-efficient will be positive – the more waste being recovered under an option, the more likely respondents will choose that option. In contrast, the expected sign for the cost attribute coefficient is negative because respondents will prefer cheaper options to more expensive options, all other characteristics being equal. Similarly, the expectation is that respondents with higher incomes would be more likely to choose options which provide greater levels of desirable attributes. A positive sign on the income co-efficient would therefore be expected.

The most basic specific functional relationship used in Choice Models is Conditional Logit (CL). The form of this relationship enables the estimated relationship between probability and attribute levels to be interpreted as an expression of the utility or well-being experienced by respondents through their choice of the alternative re-cycling options.

The Conditional Logit Relationship

Ua = β_A A + β_S S

Ub = ASC + β_A A + β_S S

Uc = ASC + β_A A + β_S S

Where:

U is the utility associated with choice options **a**, **b** and **c**, with option **a** being the 'status quo' or 'no new recycling scheme policy' option, and **b** and **c** are the alternative change options;

ASC is an Alternative Specific Constant used to reflect the unobserved factors not captured by the model that influence respondents to choose the change options over the status quo;

β_A is the set of coefficients related to the choice attributes A; and,

β_S is the set of coefficients related to the respondent socio-economic characteristics.

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The use of conditional logit models makes a specific assumption regarding the distribution of the error term. The assumption requires that the inclusion of choice alternatives that are independent make no difference to the respondents' choices. This is the Irrelevance of Independent Alternatives (IIA) property. Where this condition is breached, more sophisticated modelling techniques are used, specifically, Random Parameter Logit (RPL). These models allow for the β parameter estimates to be distributed rather than being fixed. Because IIA violations were found in the initially estimated conditional logit models, the models reported in the next section as the estimates of the ASC and β parameters, are RPL models. Improvements in model fit were also achieved by specifying the models to take account of the blocked nature of the experimental design (a random effects model) and by allowing the error component of the data to be modelled including recognition of respondent heterogeneity. The models were estimated using NLOGIT version 4.0 software.

RPL relaxes the IIA assumption and accounts for observed and unobserved preference heterogeneity across respondents. In the RPL model, it is assumed that the random vector $ß_n$ varies among respondents. The utility function is described as:

$U_{an} = ß_n X_{a\,n} + e_{an} = ßX_{an} + ð_n X_{an} + e_{an}$

where ßn is the sum of the population mean ß and individual deviation from the mean $ð_n$. Therefore the stochastic part of utility $ð_n X_{an} + e_{an}$ is correlated among alternatives (Alpizar et al., 2001). This relaxes the IIA "despite the presence of the IID assumption[9] for the random components (e_{an}) of the alternatives". This means that the RPL model separates IIA from IID and allows cross-correlation amongst alternatives in the estimated models (Hensher and Reyes, 2000).

The researcher does not know the individual's preferences, and so it is assumed that individual preferences vary across the population with density *f(ß/ θ*)*, where θ* are the parameters of this distribution (representing the mean and standard deviation of preferences) (Train, 1998). Hence the probability that the individual *n* chooses the alternative *a* can be expressed as the integral of the conditional probability (equation 4) over all possible values of *ß* weighted by the density of *ß* (Train, 1998). The probability of individual choices is given by:

$$P_{an} = \int \left(\frac{\exp(\beta n\, x_{an})}{\sum_j \exp(\beta n\, x_{jn})} \right) f\left(\beta / \theta * \right) d\beta$$

Protest responses

Some respondents to the survey provided answers to the choice sets that could be interpreted as "protests" against the form of the question rather than true statements of their preferences. These "protest responses" were identified by asking follow-up questions to respondent. Respondents who always selected the status quo option were asked for the reasons for their choice. If they indicated that they did not choose an alternative because of an objection to paying or a belief that the government should pay, they were classified as protest respondents. Similarly, respondents who selected some change options were asked whether they made this choice without believing that they would really have to pay the nominated amount, in which case their response would be of limited validity.

[9] The IID assumption refers to the assumption that the random error components are independent and identically distributed.

The choice models were estimated with these protestors included in the sample. To test if their presence has an impact on the choice model – and hence the value estimates – a dummy variable was created that was coded one for protestors and zero otherwise. It was found that this protest dummy variable was not a significant predictor of choice in the estimated models. Therefore, as it was demonstrated that protest respondents inclusion into the sample did not influence the WTP, they were included in the model analysis of the main survey.

Section 4 Results and Interpretation

This section has been structured around three major sub-sections (after a short summary and a survey completion section). The first sub-section describes the checks carried out to make sure that the characteristics of the sample population fit with the overall population of the cities included in the survey. The second sub-section reports on the questions leading to the Choice Modelling section (attitudes, television and computer ownership). The last sub-section describes the results and the analysis of the WTP choice modelling.

4.1 Summary

The survey revealed that television/computer ownership is common, with the average household owning almost seven individual items. There is was a possibility that the use of an online panel for the survey may have created a bias towards computer users. Section 4.5.2 explores this potential bias in the light of the available information in this rapidly changing field.

The model used to estimate the WTP proved to be a good fit with the data, and explained much of the variation in respondents' choices. Respondents who were younger, with higher income, or who lived in units/townhouses, had higher WTP. Respondents were also more willing to pay for the kerbside pickup option, although this was not as clear as could be expected. The socio-economic characteristics of the respondents were found to be well aligned with those of the overall population, except for the level of education, which was higher on average than in the populations of each city. There was also some mis-alignment in the income categories. These were not considered of such a magnitude as to create significant distortions in the WTP figures.

For all respondents, the household WTP for a one percent increase in e-waste recycling was $0.50 per new item (television or computer) bought, with a [$0.43 - $0.56] 95% confidence interval. Extrapolating this to the entire population of the selected cities (Adelaide, Brisbane, Melbourne, Perth and Sydney) and applying the number of items that people intend to buy in the next five years, suggests a WTP figure of between $3.6 and $4.2 million over 5 years for a one percent increase in recycling. This is starting from a base case of 1% recycling, hence the WTP for a recycling scheme achieving 50% and 90% recycling would be between $176 and $206 million and between $320 and $374 million respectively, over the next 5 years for the 5 cities concerned. The variation between the populations of individual cities was not found to be statistically significant.

4.2 Survey completion rate

It is common for response rates to tend to be lower for online surveys compared with telephone or in-person surveys. For this particular study, 18.6 percent of those people who were invited to undertake the survey actually chose to do so. 626 of these people dropped out without finishing the survey, whilst 1,275 were excluded as their quotas had already been filled. It must be noted that with this system of limited survey timeframe, successive invitation rounds and quota management makes it virtually impossible to estimate an actual response rate for the survey.

It is sometimes the case that individuals attempt to complete the survey as quickly as possible in order to qualify for the reward, and do not properly consider their answers. Those individuals who completed the survey in under six minutes or who chose answers in the same position in every page (flatlined) were excluded from the survey. The validity of their answers was viewed as questionable and therefore was not used in the analysis, or for purposes of comparison. The final number of completed surveys was 2,105.

Table 4-1 Survey response data

	No. participants
Received invitation to participate	24,508
Started survey	4,567
Stopped	626
Quota full	1,275
Completed survey	2,623
Removed due to speed / flat-lining	518
Final completed surveys	2,105
Surveys analysed statistically	2,101

4.3 Characteristics of the sample

4.3.1 Testing the sample

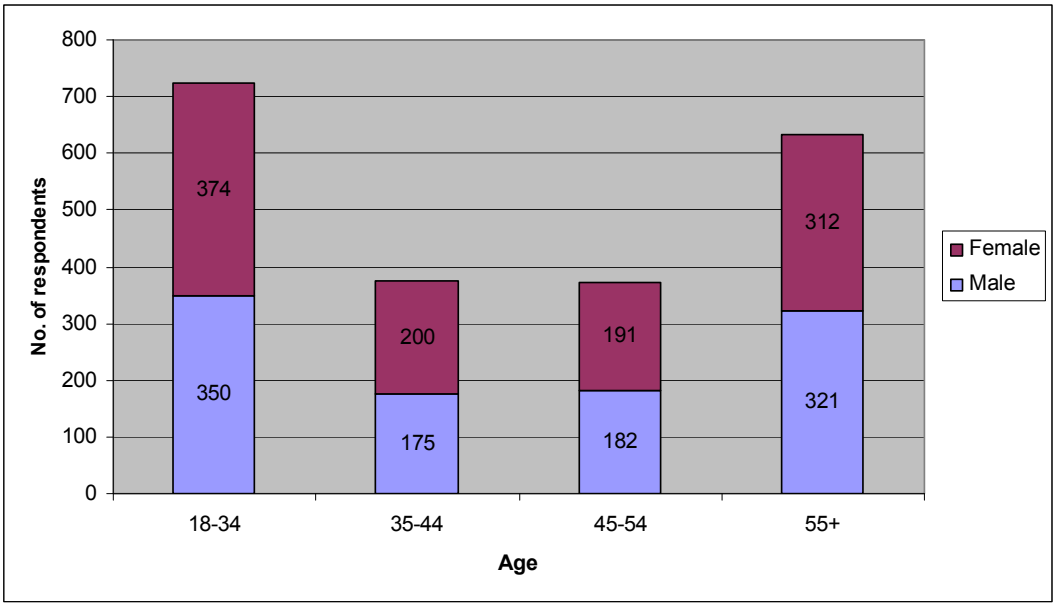
Comparison with data from the ABS for the cities surveyed indicates that the respondent population is broadly representative of the population of each city covered by the sample. A popular and simple statistical test, the chi-squared test, was performed to validate the data. Results for the parameters tested (gender, age, income, education, household structure and dwelling type) are discussed within their respective sections. Detailed results of the chi-squared test and p-values are provided in Appendix D.

4.3.2 Age and gender

The results obtained showed that 1077 respondents were female and 1028 were male. This constitutes a female response rate of 51.16% and male response rate of 48.85%.

The results obtained show that the median respondent age was between 35 and 44 years old. The chi-squared test revealed that both the age and gender distributions of the survey respondents are statistically representative of the sample population as a whole, both as an aggregate and when broken into individual survey cities. The age-sex breakdown of survey respondents is illustrated in the chart below.

Chart 4-1 Age and gender composition of survey respondents (Qs 1 &2)



Section 4 Results and Interpretation

4.3.3 Household and dwelling types

Seventy per cent (or 1466 respondents) of the sample respondents categorised their household composition as families (39.3 per cent) or couples without children (30.3 per cent). Households least represented in the survey were single person (14 per cent) and shared households (13 per cent).

Household composition in relation to families and couples without children was approximately consistent with that obtained by the ABS (ABS 2007a). The data indicates that 72 per cent of the Australian population categorised themselves with this status. There is a divergence of the sample survey from population census statistics with the number of respondents who registered their household composition as being in shared households being 9 per cent greater than the population data collected during the 2006 Census. It is not anticipated that the higher proportion of shared households would significantly affect the results of this study.

Chart 4-2 Household composition and dwelling structure (Qs 27 & 28)

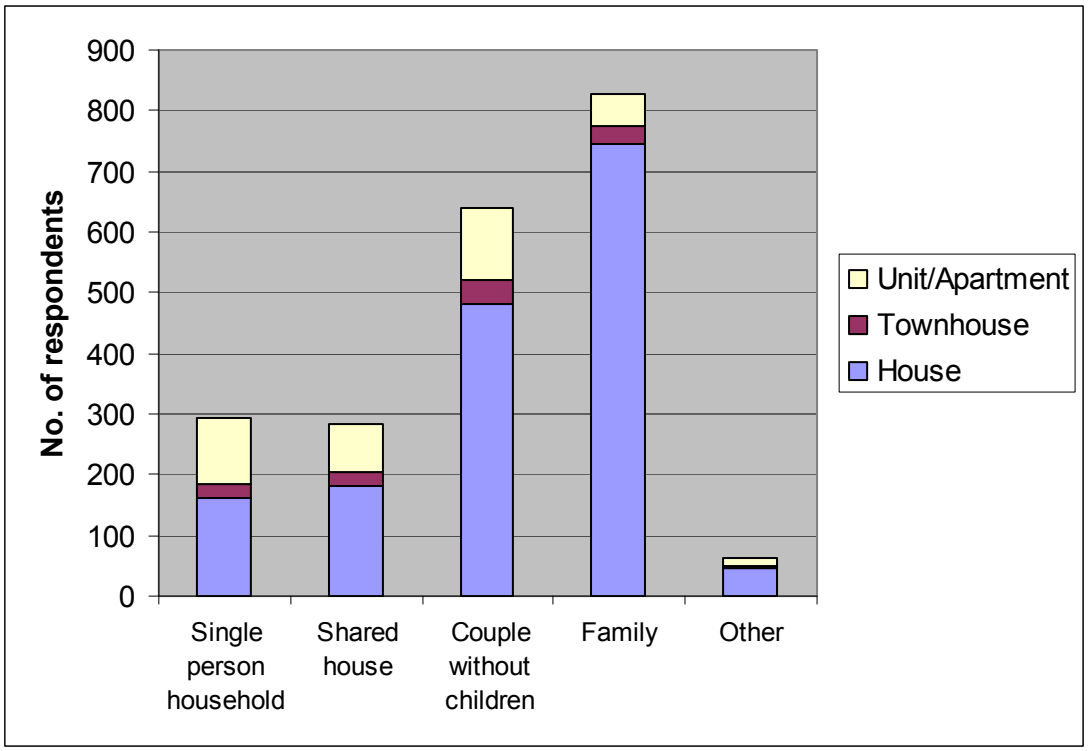


Table 4-2 Household structure by dwelling type (Q27 & 28)

		Household structure					
		Single person household	**Shared house**	**Couple without children**	**Family**	**Other**	**Total (% of column)**
Dwelling type	House	55%	64%	75%	90%	77%	77%
	Townhouse	7%	8%	6%	4%	3%	6%
	Unit/Apartment	38%	28%	18%	6%	20%	18%
	Total (% of row)	14%	13%	30%	39%	3%	100%

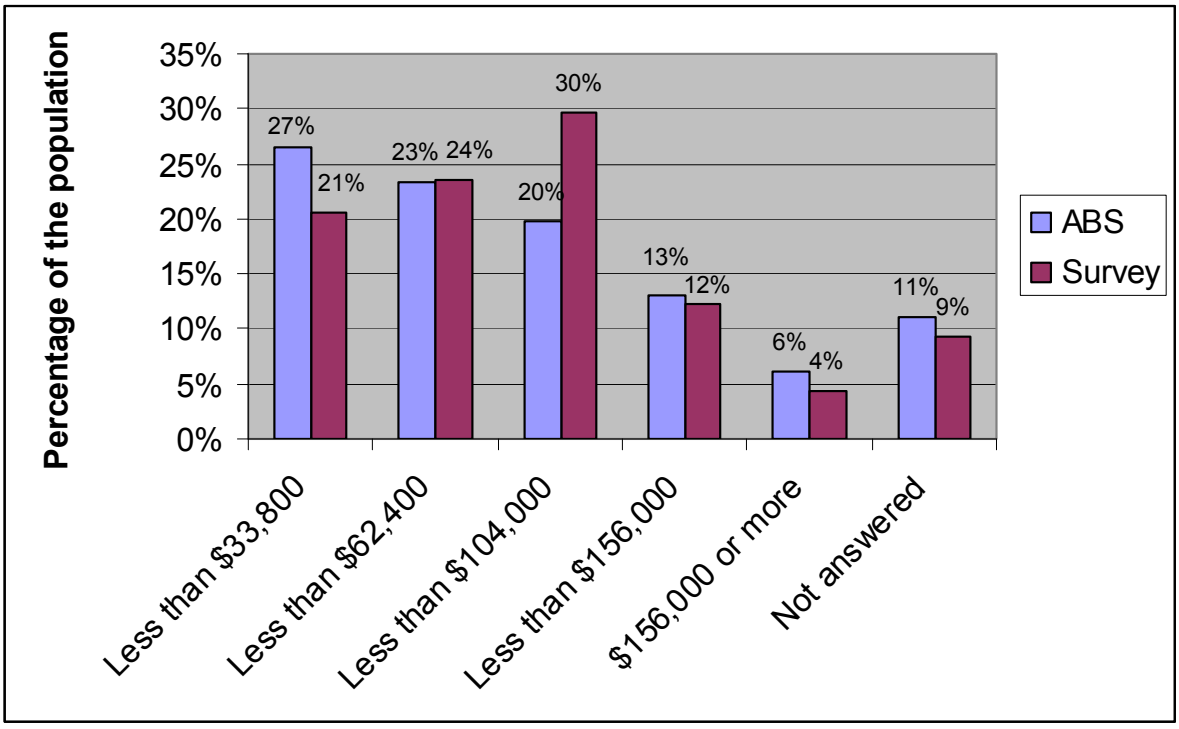
4.3.4 Income and education

Income

The survey sample population median household income fell in the $62,400 or $72,799 per year brackets (the higher median applying to Sydney). A quota had been set around this number to ensure appropriate representation and the results are therefore consistent with the wider population in the surveyed cities. It is also consistent with the Australian population as per the ABS data. Nine percent of respondents provided a "Don't Know" response, which is in line with the usual abstention rate for income questions.

The Chi squared test on the income variable showed that the sample distribution was significantly different to the population. This is due to the fact that ABS income categories are very narrow while quotas were based on an above/below the median split. As shown in a simplified graph (grouped income categories) on Chart 4-3, there is an over-representation of medium-high household incomes and an under-representation of low income. It must however be noted that the 2006 ABS data has not been adjusted for CPI (Consumer Price Index), and the median income was taken from this unadjusted 2006 data. There may be more people in 2009 with income above the 2006 median, therefore people with higher incomes may appear to be over-represented due to the inability of referring to the 2009 median.

Chart 4-3 Simplified annual household income levels



Additional analysis was undertaken to calculate WTP estimates for broad income categories (low, medium, high). The work undertaken and the results of the analysis are described in sections 4.6.4 and 4.7.4. The results of the analysis provide WTP estimates that can be used for sensitivity testing, in particular in any subsequent Regulatory Impact Statement.

Section 4 Results and Interpretation

Education

Seventy percent of respondents had completed at least up to secondary education (including diplomas and/or certificates) and 29 percent have completed tertiary or higher studies. The education levels of respondents are higher than the average for the sample population, where only 19 percent have completed tertiary or higher studies (ABS 2007b). No specific quota was set for education, so it appears that more highly educated respondents self-selected to answer the survey. The chi-squared test showed that education levels for the respondent samples (per city) were different to the ABS Census population. However, this was difficult to assess with precision, as definitions for education levels in the survey and in the ABS Census were slightly misaligned. As for the income variable, additional analysis was undertaken to provide WTP estimates that can be used for sensitivity testing. The results of this analysis are presented in sections 4.6.4 and 4.7.4.

Work was also undertaken to assess the relationship between education and income levels in the sample. (Chart 4-4 and Table 4-9).

Testing to determine the extent of the relationship between education levels and income suggests only a weak relationship between the two variables. The Kendall's tau-b correlation coefficient was 0.18, which indicates an increase in education is slightly correlated with increase in income (1 being a perfect positive correlation, and -1 being a perfect negative correlation).

Chart 4-4 Education and income levels (Qs 4 & 29)

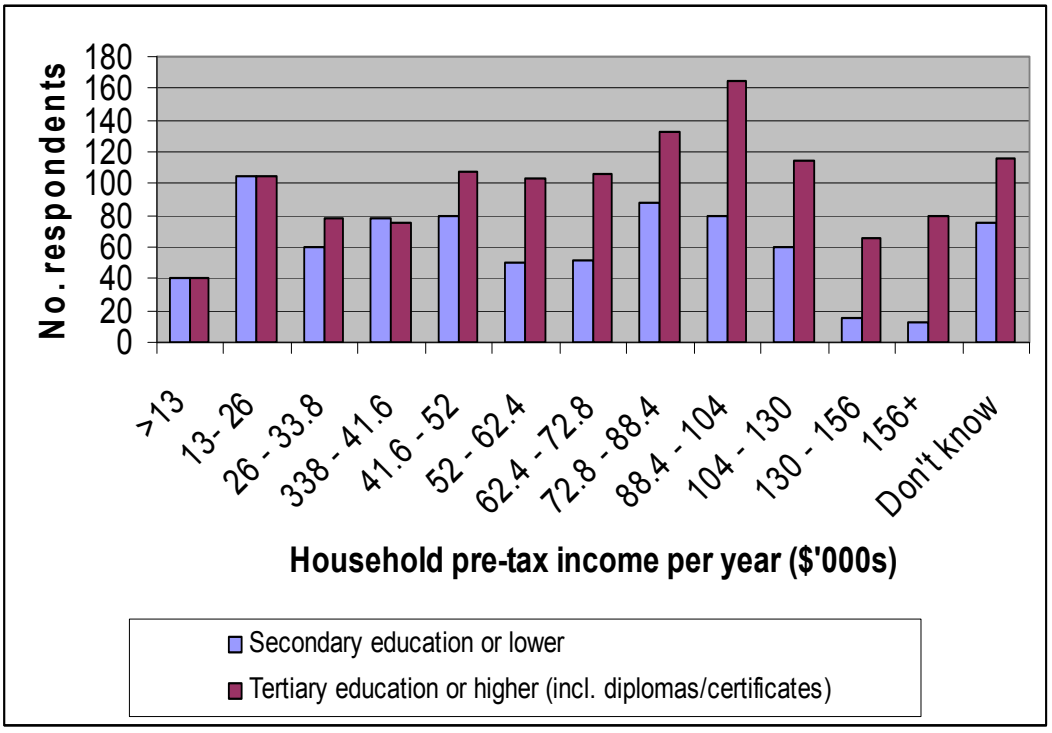


Table 4-3 Level of education by household income (Q4 & 29)

		Level of education		
		Secondary education or lower	Tertiary education or higher (incl. diplomas/certificates)	Total (% of column)
Household pre-tax income per year ($'000s)	>13	49%	51%	4%
	13- 26	50%	50%	10%
	26 - 33.8	43%	57%	7%
	338 - 41.6	51%	49%	7%
	41.6 - 52	42%	58%	9%
	52 - 62.4	33%	67%	7%
	62.4 - 72.8	33%	67%	8%
	72.8 - 88.4	40%	60%	11%
	88.4 - 104	33%	67%	12%
	104 - 130	34%	66%	8%
	130 - 156	20%	80%	4%
	156+	14%	86%	4%
	Don't know	40%	60%	9%
	Total (% of row)	38%	62%	100%

4.3.5 Employment

In general, the survey respondents were slightly more likely to be unemployed than the overall population in their respective cities, but also more likely to be participating in the labour force. Altogether, considering that no quota was put on this variable, the alignment of the sample and the overall population is considered as very good.

Chart 4-5 Labour force status

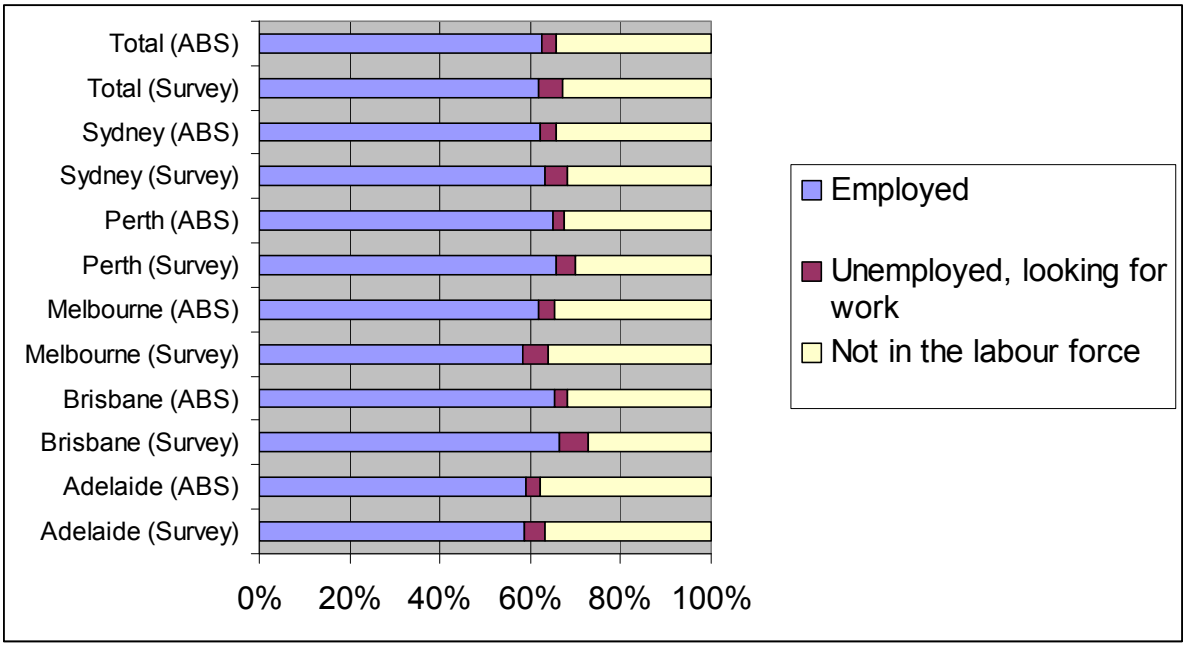


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Table 4-4 Labour force status

		Employed	Unemployed, looking for work	Not in the labour force	Total
Adelaide	Survey	179	14	112	305
	(%)	58.7%	4.6%	36.7%	
	ABS	509,268	28,204	325,006	862,478
	(%)	59.0%	3.3%	37.7%	
Brisbane	Survey	204	20	83	307
	(%)	66.4%	6.5%	27.0%	
	ABS	862,353	39,268	417,700	1,319,321
	(%)	65.4%	3.0%	31.7%	
Melbourne	Survey	350	33	217	600
	(%)	58.3%	5.5%	36.2%	
	ABS	1,685,964	94,822	944,691	2,725,477
	(%)	61.9%	3.5%	34.7%	
Perth	Survey	200	13	92	305
	(%)	65.6%	4.3%	30.2%	
	ABS	*704,118*	*26,516*	354,549	1,085,183
	(%)	64.9%	2.4%	32.7%	
Sydney	Survey	371	31	186	588
	(%)	63.1%	5.3%	31.6%	
	ABS	1,903,525	106,483	1,052,819	3,062,827
	(%)	62.1%	3.5%	34.4%	
Total	Survey	1304	111	690	2105
	(%)	61.9%	5.3%	32.8%	
	ABS	5,665,228	295,293	3,094,765	9,055,286
	(%)	62.6%	3.3%	34.2%	

4.3.6 Conclusion

Overall, the respondents to the survey were representative of the population of the respective cities included in the survey. Setting some quotas helped to achieve this representativeness. However, a bias towards slightly wealthier and slightly more educated people was observed, which may influence the WTP as these two variables were found to be significant in the statistical modelling. Although the magnitude of the bias was considered unlikely to have a significant impact on the overall results, additional analysis was undertaken to provide WTP estimates that could be used to carry out a sensitivity analysis. Results are presented in sections 4.6 and 4.7. It is anticipated that those results could be used to inform sensitivity testing in a Benefit Cost framework such as that required in a Regulatory Impact Statement.

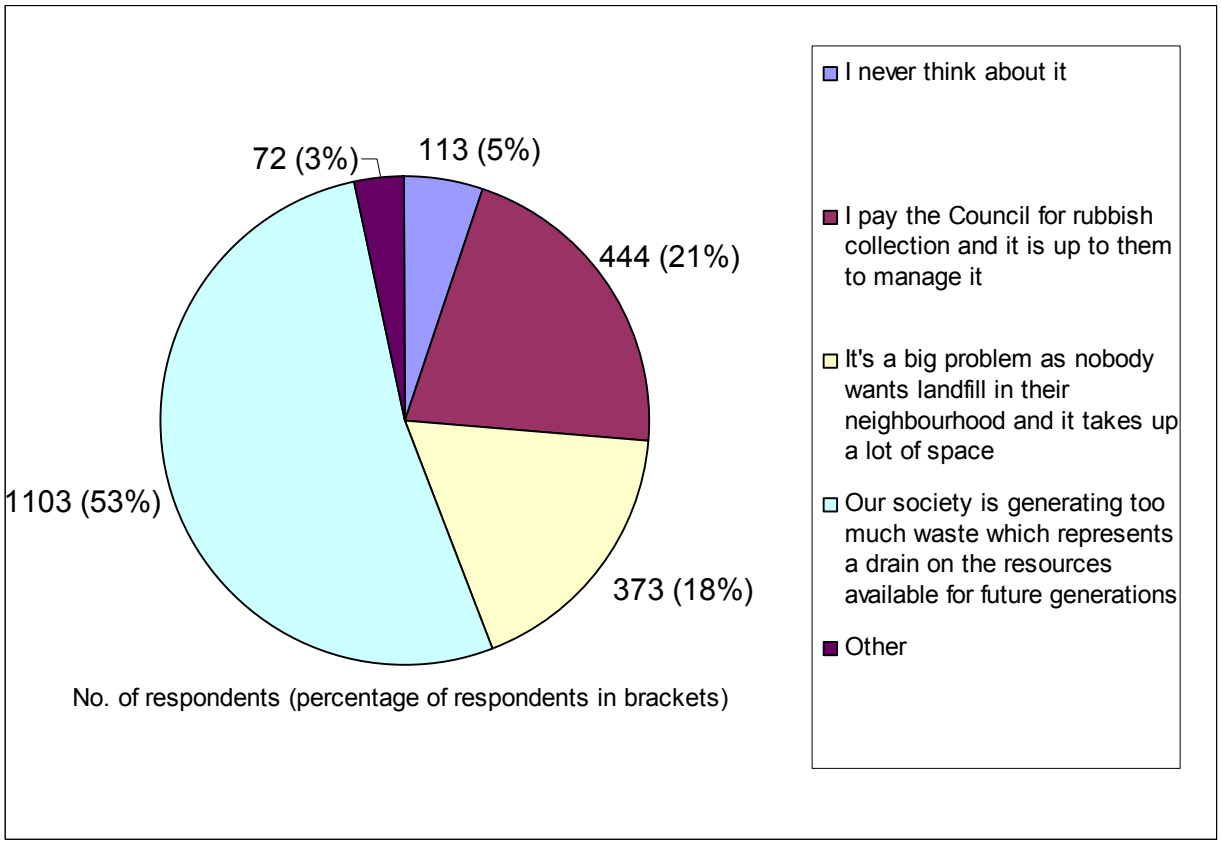
4.4 Respondents' attitudes and behaviours

4.4.1 Current recycling practices

Ninety-five percent of the sample population think about dealing with household waste and 1,994 (95 percent) have recycling bins in their household. Fifty-two per cent of survey respondents were of the opinion that society is generating too much waste, representing a drain on the resources available for future generations. Twenty-two percent believe it is up to the Council to manage the waste issue, as they collect the rubbish collection levy. Less than one-fifth of respondents believe that household waste is a big problem because of the threat of landfill in the neighbourhood (Chart 4-1). Opinions expressed in the category "other" were of the following nature:

- Respondents in general do what they can to deal with household waste especially in relation to recycling;
- The cost of recycling limits the willingness to continue or further the practice; and
- Accommodation logistics (for example, living in high rise buildings) limit the ability of respondents to recycle.

Chart 4-6 Attitudes towards household waste (participants asked to select one option) (Q5)



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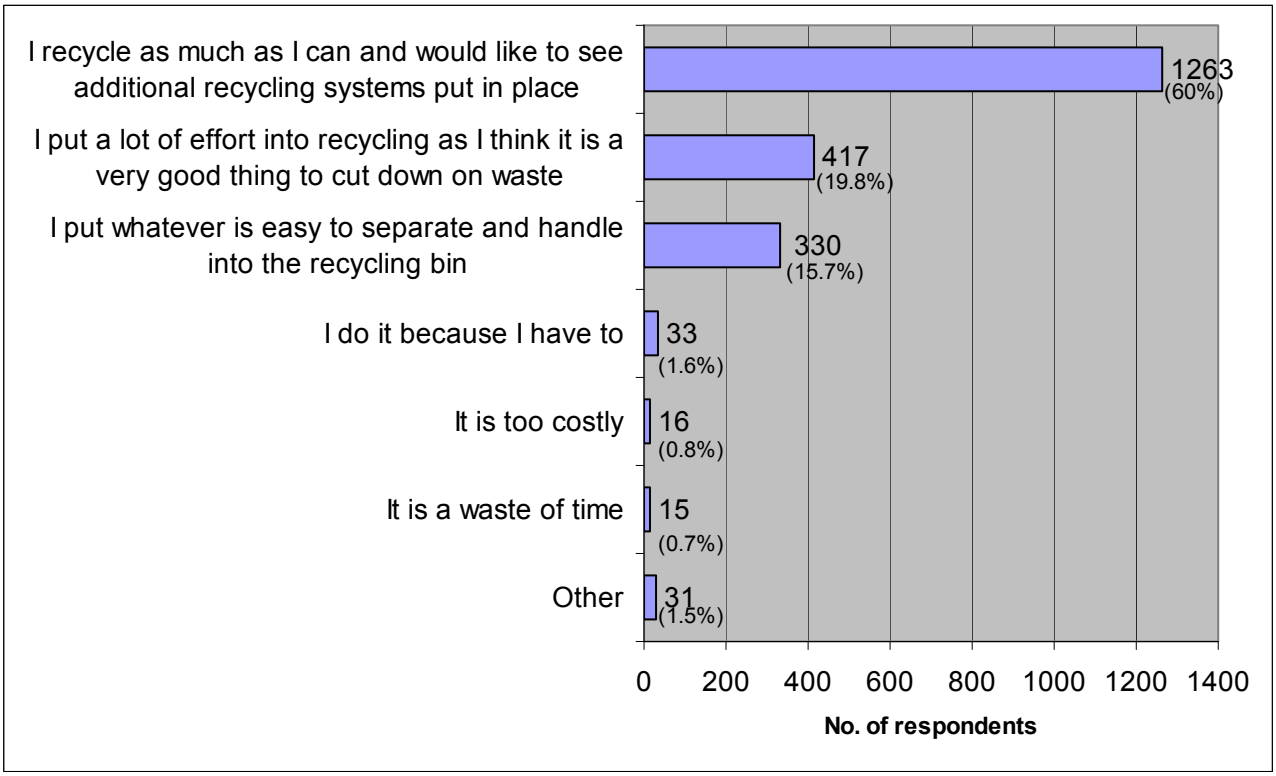
4.4.2 Attitudes towards recycling

When asked about their specific attitude to recycling, the first response by far is that households recycle as much as they can and would like to see additional recycling systems put in place for the items that cannot currently be reused or recycled (Chart 4-7). There may be a "compliance" bias here, as respondents may have seen this as the answer expected from them. A prominent 60 per cent of the respondents were of this opinion. This compares with 20 per cent of respondents who selected that they put a lot of effort into recycling as they believe it is a very good thing to cut down on waste, and the 16 per cent who indicated that they put whatever is easy to separate and handle into the recycling bin. Dismissive answers (too much time, too costly…) were not common. Reoccurring opinions expressed in the category 'other' were:

- The local council does not provide recycling bins or recycling collection systems or there are no community recycling plants in the region;
- The respondent does not recycle;
- Recycling is too expensive in terms of resources and too difficult; and
- Scepticism of the recycling process.

Chart 4-7 Opinions of recycling (participants asked to select one option) (Q7)



Materials reported to be most recycled through a system of recycling bins were:

- Paper and paper related products including cardboard, marketing materials, newspapers and phone books;
- Glass products including bottles;
- Plastic goods including milk bottles and soft drink bottles; and
- Metal cans and tins including aerosols.

Based on comments received, respondents will recycle those goods which the council or recycling collection enterprise has indicated are appropriate for recycling.

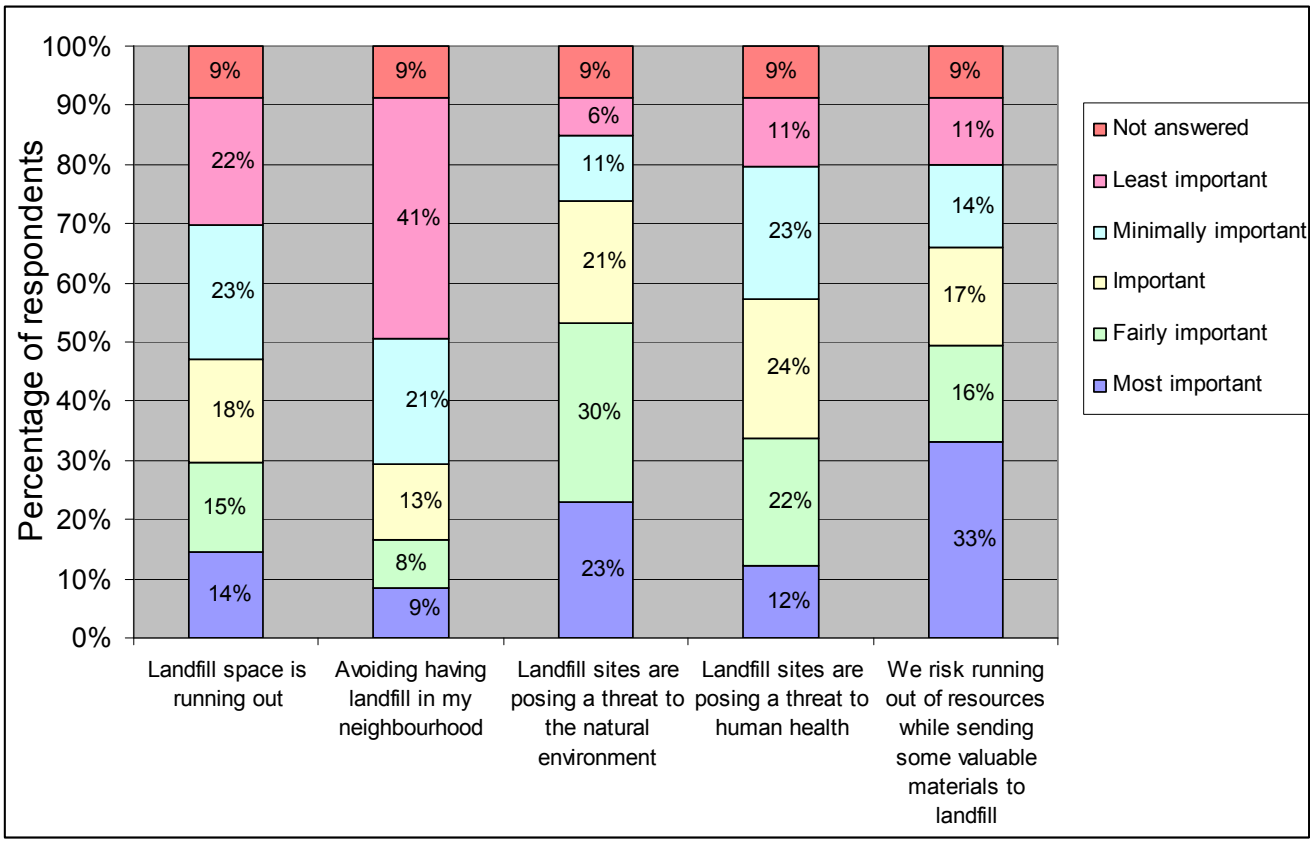
Additional materials which are not collected for recycling through the recycling bin collection system and which respondents recycle are:

- Green waste including food scraps, grass clippings and pruning off-cuts;
- Grey water from various household activities and rain water;
- Printer/ink cartridges, batteries and discarded mobile telephone devices; and
- Clothing articles.

4.4.3 Potential issues in dealing with household waste

When surveyed on the potential issues in dealing with household waste, the issue of major importance to respondents was the risk of running out of resources while sending valuable materials to landfill (of major importance to 33 per cent of respondents). The most common issue of high importance was the threat upon the natural environment of landfill sites (30 per cent of respondents). The issue of least importance was avoiding landfill in the respondents' neighbourhoods (Chart 4-8).

Chart 4-8 Potential issues of dealing with household waste (participants asked to rank in order of importance) (Q6)



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4.5 Ownership, purchasing intentions and disposal of televisions and computers

4.5.1 Television/computer ownership

From the full sample, the average number of televisions owned per household is 2.87, with 29.7 percent of respondents having 4 or more televisions at home. By city, Adelaide had the highest percentage of households with 4 or more televisions (39 percent) and the lowest percentage of households without televisions (0.3 percent).

Chart 4-9 Television ownership (Q11)

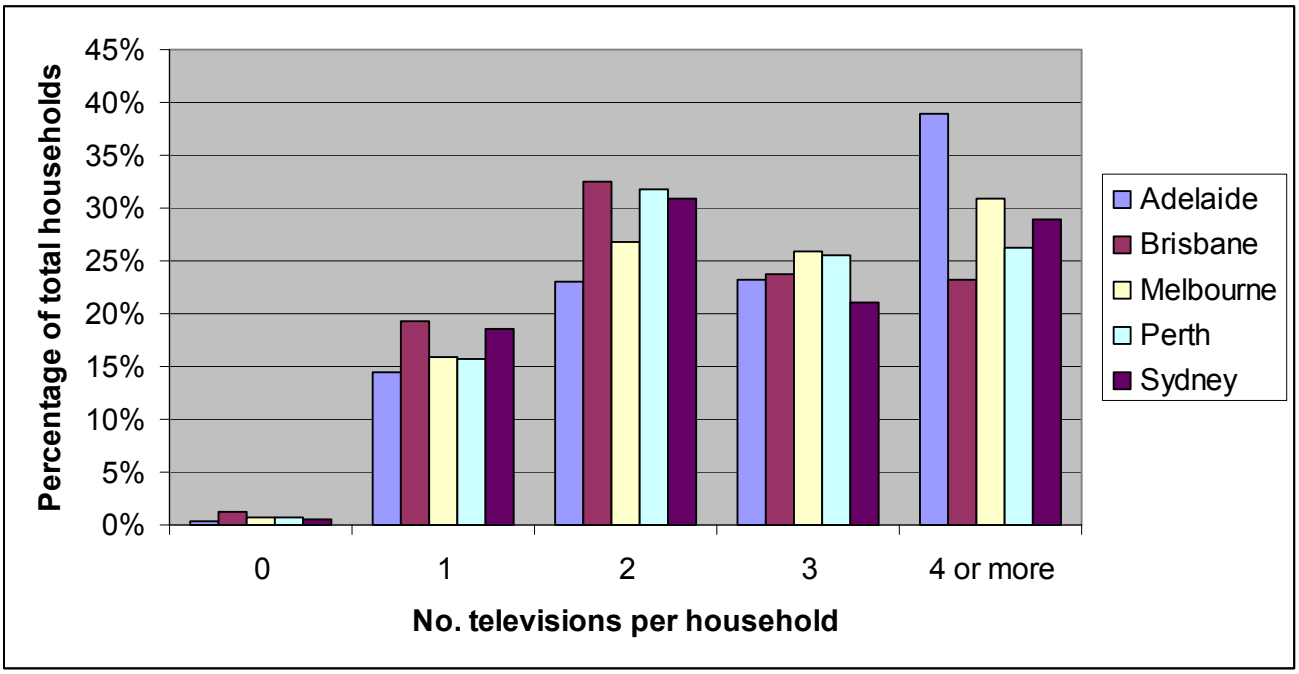

Table 4-5 Television ownership (Q11)

No. televisions per household	Adelaide	Brisbane	Melbourne	Perth	Sydney	Total	Total (% of column)
0	1	4	4	2	3	14	1%
1	44	59	95	48	109	355	17%
2	70	100	161	97	182	610	29%
3	71	73	155	78	124	501	24%
4+	119	71	185	80	170	625	30%
Total households	**305**	**307**	**600**	**305**	**588**	**2105**	**100%**

Adelaide also had the highest rate of desktop computer ownership, with 1.83 CPUs per household and 1.77 monitors. The highest rate of laptop ownership was in Sydney, with nearly 1 laptop per household (0.99 per household).

Chart 4-10 Monitor ownership (Q12)

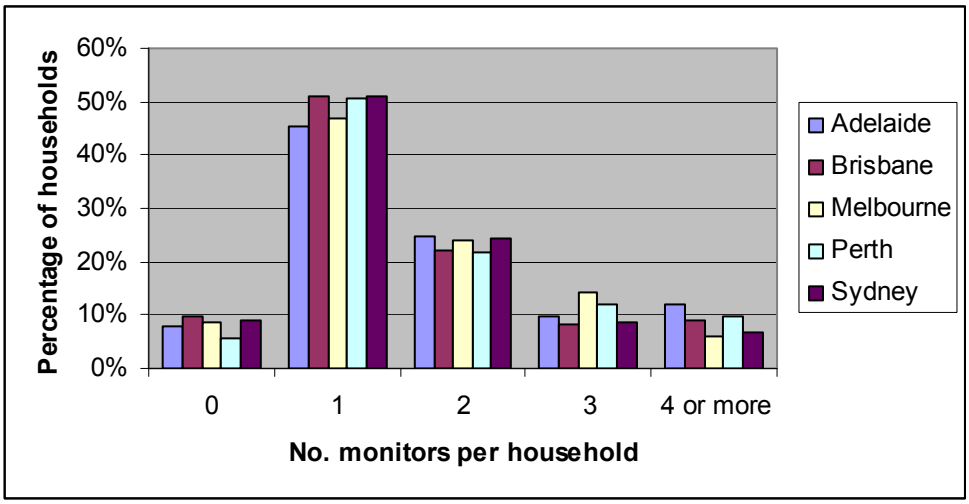

Chart 4-11 CPU ownership (Q12)

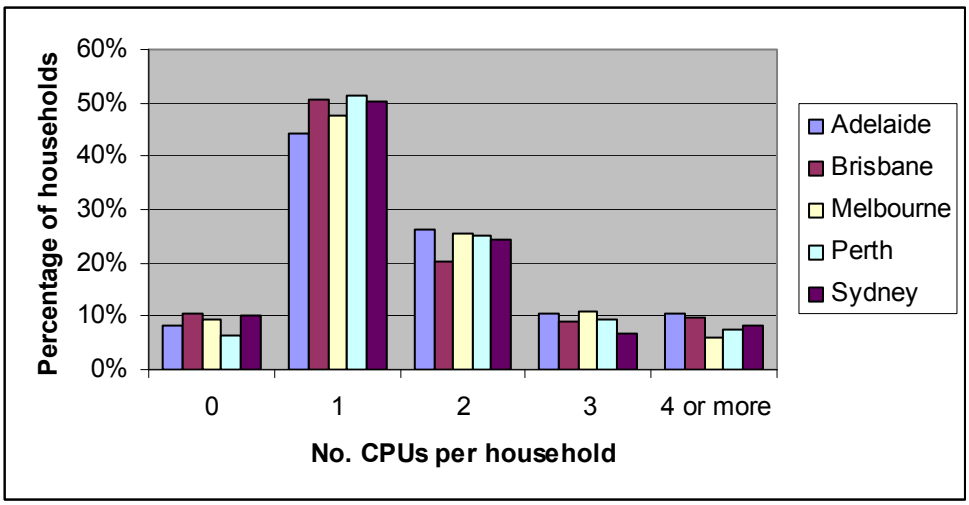

Chart 4-12 Laptop ownership (Q12)

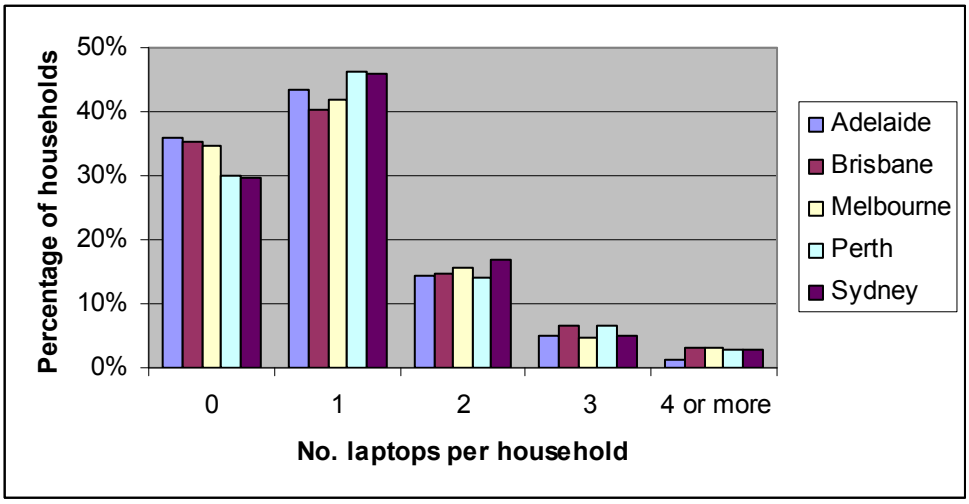

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Table 4-6 Computer item ownership[10] (Q12)

		Adelaide	Brisbane	Melbourne	Perth	Sydney	Total	Total (% of column)
No. of CPUs owned	0	24	30	54	18	57	183	9%
	1	129	146	271	142	280	968	49%
	2	76	58	145	69	136	484	24%
	3	31	26	62	26	38	183	9%
	4 or more	31	28	35	21	46	161	8%
	Total	291	288	567	276	557	1979	100%
No. of monitors owned	0	23	27	48	15	49	162	8%
	1	132	141	260	139	279	951	49%
	2	72	61	133	60	134	460	24%
	3	28	23	79	33	48	211	11%
	4+	35	25	33	27	38	158	8%
	Total	290	277	553	274	548	1942	100%
No. of laptops owned	0	103	101	194	85	165	648	33%
	1	125	116	233	131	256	861	44%
	2	41	42	87	40	93	303	15%
	3	14	19	26	19	27	105	5%
	4 or more	4	9	18	8	15	54	3%
	Total	287	287	558	283	556	1971	100%

This study indicates that for the cities examined, the average household has:

- 2.87 televisions;
- 1.58 Central Processing Units (CPUs);
- 1.55 monitors; and
- 0.96 laptops.

Only 0.7 percent of the survey population did not have a television in their household, and 8.7 percent did not have a CPU (this bias towards computer owners was to be expected, given the nature of the survey, however, as the WTP question was asked for televisions and computers together, the bias can be considered as smoothed out in the results). The high level of blank answers (6%) to the CPU ownership question compared with the television ownership question (no blank answers) may possibly be due to the terminology used – most people are very familiar with televisions, but less so with the term 'central processing unit'.

4.5.2 Comparison with other available data

The latest available data on television and computer ownership was obtained from a study conducted in 2005 by Ipsos Consulting for the NSW Department of Environment and Conservation (Ipsos 2005). This study found that:

- 99 percent of households had at least one television (average 2.3 televisions per household),
- 67 percent had at least one monitor (average 1 monitor per household),

[10] Data excludes blank responses

- 66 percent had at least one CPU (average 1 per household), and
- 23 percent had a laptop (average 0.3 per household).

These numbers could suggest that the survey population of this current study has a greater uptake of technology than average. Indeed, as the survey used an online panel, it is likely that the computer uptake by the panellists should be higher than the rest of the population. This would however not necessarily be the case for televisions.

It seems likely that the main explanation factor for differences lay in the time lag between the two studies and the ongoing trend for the uptake of such technologies. The Ipsos study was conducted four years ago, and at the time noted that items such as televisions and computers were being purchased by households at twice the rate they were being disposed of. This current study therefore essentially demonstrates the increasing trend towards ownership of televisions and computers that was identified by Ipsos.

4.5.3 E-waste disposal

On average, respondents disposed of 0.43 televisions, 0.31 computers and 0.07 laptops every two years. As the table below demonstrates, there are a number of options for e-waste disposal, with more than one option proving popular. Giving away, leaving out for kerbside collection, and taking to a recycling facility are the top three options for both televisions and computers. Although respondents were asked only to think about how they disposed of *worn-out* televisions and computers, it is possible that they counted televisions/computers still in working order, hence the high percentage of those items that are given away.

Table 4-7 Disposal methods for televisions and computers (Q14 & 16)

Method of disposal	Televisions		Computers	
	No. of televisions	**Percentage**	**No. of CPUs/monitors/laptops**	**Percentage**
Sold	55	5.8%	104	6.1%
Given away	213	22.4%	425	25.0%
Traded in	9	0.9%	58	3.4%
Took to recycling facility	180	18.9%	280	16.5%
Left in front of house	116	12.2%	142	8.4%
Took to tip	124	13.0%	175	10.3%
Left for normal rubbish collection	42	4.4%	139	8.2%
Left for kerbside collection	200	21.0%	377	22.2%
Collected by store that sold replacement	12	1.3%	Not asked	
Total	951	100.0%	1700	100.0%

4.5.4 Purchasing intentions

Survey respondents were asked about their intention to purchase televisions or computers in the next five years. On average, respondents intended to purchase 0.82 televisions and 0.94 computers over this timeframe. Adelaide respondents had the highest number of intended purchases of televisions or computers, although the difference between individual cities was small (less than 7 percent).

Section 4 Results and Interpretation

4.6 Analysis of the Choice Modelling survey

4.6.1 Introduction

This section presents the statistical analysis work done on the data and the building of analytical models with satisfactory explanatory power and good statistical indicators. It also expands on the additional sensitivity analysis work done on the income and education variables. The next section expands on the calculation of the WTP. 85 percent of respondents stated some WTP for e-waste recycling.

4.6.2 Statistical models

As detailed in the methodology (Section 3), Random Parameter Logit models were estimated for the entire sample of respondents and separately for each of the five selected cities. The variables used in the choice models to explain respondent wellbeing are set out in Table 4-8 and the models – for all respondents and separately for the respondents for each of the selected cities - are presented in Table 4-10. The variables included in the models as randomly distributed are RECOV and DROPOFF. RECOV represents the attribute corresponding to the percentage of material recovery and waste avoided achieved by a recycling scheme. DROPOFF corresponds to the collection method, which had only two levels: drop-off and kerbside.

The tables also report statistics relating to technical aspects of the model's ability to fit the choice data collected. The SD on RECOV and SD on DROPOFF (standard deviations on the random parameters) provide evidence of the importance of modelling attribute parameters as random. Similarly, the error component statistic shows the success of treating the error component as distributed. Adjusted rho squared (adj-ρ^2) statistics provide an indication of the overall goodness of fit for the models.

Table 4-8 Choice modelling variables

Variable Code	Description
ASC	Alternative Specific Constant (coded 1 for the change options)
Option attributes	
COST	$ per unit purchased
RECOV	Percentage of e-waste recovered
DROPOFF	Recycling collection method (coded 1 for drop off and zero for kerb-side)
Respondent Socio-economic Characteristics	
AGE	Age (years)
EDUC	Education (years)
INC	Income ($000 pa)
GEN	Gender (coded 1 for male)
UNIT	Type of residence (coded 1 for unit/townhouse)
INCMIS	Income not disclosed (coded 1 for not disclosed, with average income included as INC)

Table 4-9 Choice model results[11]

Variable	Full sample		Sydney subsample		Perth subsample		Melbourne subsample		Brisbane subsample		Adelaide subsample	
	Parameter	**Z-value**	**Parameter**	**Z-value**	**Parameter**	**Z-value**	**Parameter**	**Z-value**	**Parameter**	**Z-value**	**Parameter**	**Z-value**
ASC	0.593	0.800	-1.573	-1.059	0.483	0.217	-0.034	-0.023	1.523	0.774	-2.356	-0.875
COST	-0.062***	-43.681	-0.059***	-21.800	-0.061***	-17.286	-0.064***	-23.251	-0.059***	-16.613	-0.066***	-15.937
RECOV	0.031***	13.918	0.037***	9.000	0.033***	5.919	0.027***	6.063	0.030***	5.638	0.037***	6.186
DROPOFF	-0.219***	-2.864	-0.344**	-2.293	-0.706***	-3.299	-0.009	-0.064	0.095	0.536	-0.075	-0.367
AGE	-0.019***	-2.753	-0.013	-0.846	-0.022	-1.157	-0.025*	-1.926	-0.035*	-1.735	-0.019	-0.864
EDUC	0.137***	2.792	0.258***	2.600	0.162	1.045	0.201**	1.991	0.127	0.963	0.564***	3.096
INC	0.012***	4.065	0.011*	1.794	0.011	1.127	0.016***	2.877	0.014*	1.724	-0.007	-0.799
GEN	-0.836***	-3.743	-0.650	-1.333	-0.577	-0.889	-1.436***	-3.441	-0.804	-1.251	-1.396*	-1.913
INCMIS	-0.806**	-2.119	-0.268	-0.317	-0.911	-0.785	-1.534**	-2.168	0.830	0.682	0.282	0.244
UNIT	0.700**	2.541	1.439**	2.417	1.555*	1.698	0.008	0.017	0.303	0.437	-0.580	-0.619
SD on RECOV	0.058***	27.828	0.054***	13.498	0.056***	9.707	0.058***	13.470	0.049***	10.735	0.055***	9.797
SD on DROPOF	2.325***	30.517	2.336***	16.084	2.560***	11.149	2.197***	15.131	1.931***	10.428	2.438***	11.517
Error Component	3.560***	21.240	4.235***	11.704	4.251***	8.643	3.578***	10.750	3.711***	8.686	4.469***	8.138
Log-L	-8720.70		-2426.04		-1309.90		-2417.20		-1307.15		-1225.29	
BIC	1.393		1.410		1.485		1.370		1.477		1.397	
adj-ρ^2	0.370		0.373		0.349		0.388		0.352		0.389	
n	2101		587		305		599		306		304	

[11] *** *Significant at the one percent level*
** *Significant at the five percent level*
* *Significant at the ten percent level*

Section 4 Results and Interpretation

4.6.3 Models' internal consistency and analysis of the results

The models estimated are robust. All have adjusted rho squared statistics above 0.35. For choice modelling data, this indicates very good model fits. The rho squared value in conditional logit models can be interpreted in a similar way to the R squared in conventional regression analysis except that differing ranges apply. Hensher et al (2005, p. 38) comment that values of rho squared between 0.2 and 0.4 are considered to be extremely good fits.

In all models, the option attribute coefficients are predominantly highly significant indicating that respondents made their choices between options with reference to the attribute levels. Furthermore, the standard deviations on the random parameters for the RECOV and DROPOFF attributes are also highly significant across all models. This indicates that the use of RPL modelling is appropriate to recognise respondent heterogeneity.

The estimated attribute coefficients for COST and RECOV are signed as expected: COST has a negative sign so that more expensive choice options were less desirable and RECOV has a positive sign so that more e-waste recycling was perceived to be preferable.

In all samples, the ASC is not significantly different from zero. This indicates that there is no inherent bias toward either the change or no-change options held by respondents. The explanatory variables used in the choice models are not leaving any systematic variation in respondent choice to be taken up by the ASCs.

In the samples where respondent age is significant (full sample, Melbourne and Brisbane) the results suggest that younger people are more likely to choose a recycling option and hence are willing to pay more than older people. Males were less likely to select a change option (full sample, Melbourne and Adelaide) while better educated (full sample, Sydney, Melbourne and Adelaide) and higher income (full sample, Sydney, Melbourne and Brisbane) respondents chose change more often. Those respondents resident in units and town houses were more likely to pay (full sample, Sydney and Perth).

Put simply, the models show strong internal consistency in that the explanatory variables are consistent with expected patterns of choice.

The high levels of statistical significance associated with the standard deviations on the random parameters and the error component also indicate robust models able to produce good quality estimates.

4.6.4 Sensitivity analysis around the income and education parameters

As the structure of the sample population was not exactly aligned with the ABS data for income and education (see 4.3.4), additional work was undertaken to calculate WTP estimates for broad income and education categories. The objective was to assess the differences in WTP between high and low income respondents and between respondents with more or less years of schooling / education.

This was done by creating additional models splitting the full sample into sub-samples along income categories and education categories (rather than by city, as in Table 4-9). As a number of respondents had declined to disclose their household's income bracket (about 9%), these respondents had to be excluded from the models. The adjusted number of respondents considered was 1906 (down from 2101) and the parameters for the full sample were therefore slightly different from the full sample shown in Table 4-9.

To avoid excessive fragmentation of the results, which would have resulted in smaller sub-samples with a higher standard error, it was necessary to group the categories together. It was found appropriate to simply retrain three income categories and two education levels. Table 4-10 shows the definition of the revenue and education categories for this sensitivity analysis. The categories were chosen by finding "natural" breaking points and approximately balancing the categories. For education, year 12 was the logical break, as the sample population comprised a higher percentage of people having completed year 12 than the ABS population and vice-versa.

A summary of the results is shown in section 4.7 and the models' full results are shown in Appendix F.

Table 4-10 Sensitivity analysis - income and education variables

Category	Sample size	Percentage (in sample	Percentage (in ABS population)
Full Sample	1906		
Income level (per year)			
Low (less than $41,600)	588	31%	37%
Medium ($41,600-88,400)	721	37%	34%
High (more than $88,400)	597	32%	29%
Education level			
Less than year 12	720	38%	52%
Over year 12	1186	62%	48%

4.6.5 Protest responses

As discussed in section 3.5.4, it is common for some respondents to 'protest' about the choice scenarios offered to them. Their responses are generally considered not to be a valid representation of their WTP, as the idea of e-waste recycling may have some value but not be presented in a way that appeals to them. In this study, those who chose to pay for recycling scenarios but did so because they did not believe they would really be asked to pay the amount were coded as protests. 11 percent of respondents with a positive WTP were coded as protests. Those who did not choose to pay for recycling scenarios because they thought that the government should pay, they needed more information/time, or they objected to paying, could also be considered as protests. The majority of those who selected 'other' as a reason for non-payment were also considered to be protests. Two-third of the respondents with a nil WTP could thus be considered as protests. However, the status of protests for respondents with a nil WTP is quite different to the protests for respondents with a positive WTP, as there is no WTP to invalidate. Protest response figures are listed in Table 4-11 (note that people could select multiple responses, hence the numbers should not be summed together.)

Table 4-11 Protest responses (Q24 & 25)

Protest responses	No.
I don't believe I will really have to pay	197
Government should pay	85
Need more information/time	28
Object to paying	123
Other (please describe)	41

Examples of verbatim responses to the 'other' category are listed in Appendix E. A common response was the desire for either the council or manufacturers to pay for recycling (this is what is known as a 'free-rider' response, in that the respondent wants someone else to pay for the service).

Section 4 Results and Interpretation

4.6.6 Validity of Willingness to Pay Estimates

For this study to provide a useful gauge of WTP for e-waste recycling, it must have been performed in such a way that the results can be considered valid. Drawing on Bateman et. al (2002), there are two forms of validity applicable to stated preference studies such as this one: content validity and construct validity.

Content validity refers to the plausibility of the survey scenarios presented to participants – firstly, were the scenarios relevant to a wide range of participants from different backgrounds, and secondly, did they believe that the scenarios were realistic and could actually be put in place? Given the wide spread of television and computer ownership across Australian households, the issue of e-waste disposal can be considered relevant to the majority of Australians.

In response to the second question, stated preference surveys have previously been criticised for their hypothetical nature, with the possible implication that respondents do not answer with their true WTP because they do not believe the scenario. In the case of this study, extensive focus group testing refined the choice scenarios and removed those options which participants did not actually think were feasible. Analysis of protest responses indicates that 15 percent of respondents did not believe that they would actually have to pay for the recycling scheme they selected and a specific analysis has been carried out on this sub-sample (see 4.6.5).

Also relevant to content validity are issues relating to survey design and implementation. In the case of this study, survey participants were chosen to be a representative selection of the population as a whole, thus avoiding any possible bias. Some self-selection towards higher income and higher education groups occurred; however separate analysis of these groups has been included in the report for consideration in further sensitivity analysis. Bias was also minimised through careful questionnaire design, to ensure that respondents were presented with all the issues and could make an informed choice without being overburdened with information. Focus groups were asked to identify whether the questionnaire encouraged any form of bias in their responses, and this was corrected where present.

Construct validity refers to an assessment of whether the study results meet with other indicators – in this case, do the results agree with expectations? Results from the modelling indicate that all variables behaved as would be expected – as income rose, so did WTP, and likewise with education. The model itself can therefore be considered a very good fit for the data,

4.7 Willingness to pay for recycling

The results of the choice models reported in the previous section can be used to estimate respondents' average WTP per television or computer purchased for a one percent increase in the amount of e-waste that is recovered through recycling. This estimate is made by comparing the contributions made to respondents' utilities by e-waste recovery and the cost of a recycling scheme. This comparison is achieved by dividing the coefficient on the RECOV attribute in the choice model by the COST coefficient:

$$\text{Willingness to Pay} = -\beta_{recov} / \beta_{cost}$$

This is the amount of money respondents (on average) are willing to pay as a premium for each new computer and television they buy in order to have an additional one per cent of e-waste recovered. The WTP estimates derived from the choice models are displayed in Table 4-12. All dollar values presented in this section are in 2009 dollars.

By presenting the results in this way, it is assumed that the relationship between percentage of recovery and cost is linear (the percentage of recovery is considered as a continuous variable). To validate this, a discrete variable has been substituted to the continuous variable for recovery rate and the results were not significantly different. Hence there is no evidence of non-linearity in the presented range from 50-90%

Table 4-12 Willingness to pay for a one percent increase in e-waste recovery

Sample	Willingness to pay ($/%)	95% confidence interval ($/%)
Full	0.50***	0.43 - 0.56
Sydney	0.63***	0.51 - 0.75
Perth	0.55***	0.38 - 0.71
Melbourne	0.42***	0.30 - 0.55
Brisbane	0.51***	0.36 - 0.66
Adelaide	0.56***	0.41 - 0.72

*** *Significant at the one per cent level*

All estimates of WTP across the samples are highly significant with relatively narrow 95 percent confidence intervals. Hence, we can be 95 percent sure that the respondents are willing to pay, on average, 50 cents for an additional percentage of e-waste recovery.

4.7.1 Differences across the selected cities

The variation of WTP across the five capital cities surveyed is comparatively minor. No statistically significant differences in WTP could be found across the sub-samples. So whilst from Table 4-12 it would appear that Sydney respondents were, on average, willing to pay more (63 cents) than Brisbane (51 cents) and Melbourne (42 cents), the extent of the difference is not sufficient to make it statistically significant, as evidenced by the fact that the 95% confidence intervals for the different city by city estimates overlap.

The similarity of responses across the sub-samples also provides an indication of how robust the WTP estimates are. With a 13 cent spread across the confidence interval for the full sample, it can also be concluded that the WTP estimate of 50 cents is within a relatively tight error band.

Because the results from each of the selected cities are not significantly different in a statistical sense from the full sample of all respondents, the full sample model can be considered suitable for use in the estimation of aggregate WTP.

4.7.2 Willingness to pay for specific collection method

The respondents had to choose between two collection methods for the e-waste: either a drop-off at a local collection centre, or a kerb-side collection at a set date. The “no change” option referred to the “current collection method”, leaving it unspecified. The collection method was therefore an attribute which was modelled on three levels. However, the uncertainty around the current collection method makes the analysis more difficult, as in some Councils, kerb-side collection or drop-off centres may already exist.

The DROPOFF attribute coefficient is significant with a negative sign in the full sample and in the Sydney and Perth sub-samples. Where it is significant, the estimated coefficient is negatively signed. This indicates that respondents prefer kerb-side collection outside their residences rather than having to take their e-waste to a recycling drop-off point. The kerbside “premium” was calculated at $3.55 per item. This means that on average respondents would be willing to pay $3.55 more per item for having the convenience of a kerb-side collection method. This was largely influenced by the high premium that Sydney and Perth respondents were willing to pay ($5.88 and $11.50 per item respectively), with the other cities not being significantly different from zero. However, the confidence intervals for these figures are much wider than the WTP estimates for recycling in general (presented in Table 4-12), and therefore less reliable.

Section 4 Results and Interpretation

It is clear that there is a preference for kerbside collection, with people being willing to pay $3.55 per item in addition to what they would be willing to pay for whatever percentage of waste recovery is achieved. This figure can be used when comparing different recovery methods. However, as it is strongly associated with convenience (based on common sense and on the discussions during the focus groups), the nature of this benefit is much more akin to a private good than a public benefit (as the existence of a recycling scheme would be). Such a distinction may not have great practical implications when putting in place a recycling scheme, as the key result is that people are willing to pay to see a certain percentage of recycling and resource recovery achieved.

4.7.3 Aggregated willingness to pay

The estimates of WTP have been based on a sample of respondents for each selected city. The values have also been estimated “at the margin”. In other words, the WTP is for an increment in percentage of waste recovery. To use the estimates to inform policy decisions, extrapolations need to be made from the sample to the overall population and for the relevant percentage of recycling achieved. It is important to reiterate that increments for WTP estimates should only be used for recycling schemes delivering more than 50% of recycling: under this threshold, no WTP can be assumed, as such scenarios were not tested in the survey.

To extrapolate from the per respondent value to the aggregate value for the total population of the selected cities, three pieces of additional information are required:

- The number of televisions and computers respondents expect to buy in the coming five years, as this is the number that people would have in mind when calculating the overall cost of the scheme to their household;
- The number of households in the population;
- The percentage of the population which can be expected to respond in the same way as the respondents in the sample.

The number of televisions and computers respondents expect to buy in the coming five years is required to convert the WTP estimate derived from the choice models from a per item/per cent recovery rate figure to a per cent recovery rate basis.

Data collected in the survey on purchase intentions enables this first conversion step. Because average per respondent WTP is used in the aggregation process, the average number of computers and televisions should also be used.

The second piece of information required is the number of households resident in the area of interest. This is available from the ABS census data. Multiplying average WTP per respondent by the number of households yields the total WTP across the region of interest for a one percent increase in recovery rate.

The third element is probably the most delicate figure to estimate. The response rate is sometimes used as a point of reference. This approach takes the conservative stand that the non-response fraction of the population holds no value for increasing the percentage of e-waste that is recovered. This was considered as an overly conservative approach, considering the time constraints of respondents and the many reasons why the survey may not have reached the respondents (inactive email address, respondent on holiday, etc). An alternative measure has therefore been used.

Instead of using the number of people who started the survey divided by the number of invitations, the alternative measure used is the number of people who completed the survey divided by the number who started it. This gives an indication of the number of people who started the survey, found out what it was about, and then lost interest. It is believed that these people could be unwilling to pay for a recycling scheme, although it is recognised that other factors, for example some technicalities may have cause them to drop out of the survey. Nevertheless, it would seem to be an appropriate basis to calculate a lower boundary for the WTP estimates.

This leads to the following calculation:

Per Unit Increase in Recovery Rate Aggregate Value ($/%) = Estimated WTP x average number of televisions/computers purchased x number of households in the population x (1 – drop out rate)

For this survey, the drop out rate was 13.7%. The average number of televisions/computers that households intend to purchase in the next 5 years is 1.76 and the number of households in 5 cities surveyed is 4,294,367 (ABS 2006).

Using this equation, households in the survey population would be willing to pay a combined total of between $3.6 and $4.2 million for each percent increase in the recovery rate, above a 50% rate of recovery (see above).

Potential benefits of increasing e-waste recovery

With this aggregate figure established, the non-market benefits of schemes delivering different percentages of e-waste recovery can be estimated by multiplying the additional percentage of recovery achieved. This is the difference between the projected rate of recovery and the one per cent recovery rate achieved by the "no change" option (the status quo):

Welfare gain to society ($) = Per unit Aggregated Value x (Projected recovery rate with policy (%) - 1%)

The convenience of having the e-waste collected at the kerb-side should be added for any recycling scheme involving such a collection. The convenience element is not dependent on the percentage of recycling achieved and the calculation is therefore as follows:

Kerb-side "premium" = Estimated WTP per item x average number of televisions/computers purchased x number of households in the population x (1 – drop out rate)

For the full sample, the table below illustrates the benefits that can be achieved by increasing the amount of e-waste recovery. It presents estimates of total WTP using the confidence intervals defined in Table 4-12, and also using the drop out rate[12]. The kerb-side "premium" is presented on a separate line to be added to any recycling scheme incorporating this collection method.

[12] 100% assumes that the survey respondents are identical to the rest of the population, 86.3% allows for a number who have no willingness to pay, as discussed in section 4.7.2.

Section 4 Results and Interpretation

Table 4-13 Full sample WTP estimates

	Lower confidence interval		Average WTP		Upper confidence interval	
WTP per item per % ($)	0.43		0.50		0.56	
(1 - drop out rate)	100%	86.3%	100%	86.3%	100%	86.3%
50% recovery						
Respondent household WTP for the indicated percentage in waste recovery ($ over 5 years)	37.12	32.03	43.16	37.24	48.34	41.71
Respondent household WTP per item ($)	21.07	18.18	24.50	21.14	27.44	23.68
Total household WTP for % increase ($m over 5 years)	159.4	137.5	185.3	159.9	207.6	179.1
70% recovery						
Respondent household WTP for the indicated percentage in waste recovery ($ over 5 years)	52.26	45.10	60.77	52.44	68.07	58.74
Respondent household WTP per item ($)	29.67	25.60	34.50	29.77	38.64	33.34
Total household WTP for % increase ($m over 5 years)	224.4	193.7	261.0	225.2	292.3	252.2
90% recovery						
Respondent household WTP for the indicated percentage in waste recovery ($ over 5 years)	67.41	58.17	78.39	67.64	87.79	75.76
Respondent household WTP per item ($)	38.27	33.02	44.50	38.40	49.84	43.01
Total household WTP for % increase ($m over 5 years)	289.5	249.8	336.6	290.5	377.0	325.3
All recovery levels						
Kerb-side “premium” ($m over 5 years)	9	7.8	26.8	23.2	44.7	38.6

As discussed in section 4.7.1, the difference between the individual city subsamples was relatively minor. For comparison’s sake, the following table illustrates the range between the highest and lowest WTP estimates for each city, for a 70 percent recovery rate (assuming no drop-out). It must be noted that combining all the low estimates and all the high estimates would not be comparable to the results for the overall sample (as it no longer corresponds to a 95% confidence interval).

Table 4-14 WTP by city for a 70% waste recovery scheme (over 5 years)

	Number households	Low	Mean	High	Average no. items bought	Low	Mean	High
		$ per item				$ over 5 years for the city		
Adelaide	430,780	0.41	0.56	0.72	2.043	24,897,563	34,006,428	43,722,550
Brisbane	628,215	0.36	0.51	0.66	1.734	27,058,828	38,333,340	49,607,852
Melbourne	1,283,302	0.30	0.42	0.55	1.717	45,610,991	63,855,388	83,620,151
Perth	528,535	0.38	0.55	0.71	1.798	24,917,021	36,064,110	46,555,488
Sydney	1,423,535	0.51	0.63	0.75	1.767	88,516,445	109,343,844	130,171,243

4.7.4 Sensitivity analysis: differences across income and education categories

As mentioned in section 4.6.4, models have been built to calculate the WTP for different income and education categories, and provide a basis for sensitivity analysis. The models' parameters are presented in Appendix **Error! Reference source not found.**. WTP estimates (including confidence intervals) are shown in Table 4-15 and aggregated calculations are presented in Table 4-16 (in order to avoid over-burdening the table, only the 0% drop-out rate scenario [see above] has been reported). Aggregated results have been calculated using the percentages of the ABS population falling within each of the category. As noted above, as aggregated results combine low estimates (and high estimates respectively) for each category, the combined upper and lower bounds of the confidence interval cannot be compared to the results for the overall sample. They can however be used as bottom-end (respectively top-end) estimates for a sensitivity analysis in any Benefit-Cost Analysis of recycling scheme.

Table 4-15 Sensitivity analysis - income and education variables - WTP for a one percent increase in e-waste recovery (over 5 years)

	Sample size	Mean WTP	95% confidence interval
Full Sample	1906	0.50	0.44-0.57
Income level (per year)			
Low (less than $41,600)	588	0.28	0.12-0.45
Medium ($41,600-88,400)	721	0.44	0.33-0.54
High (more than $88,400)	597	0.64	0.54-0.73
Education level			
Year 12 or less	720	0.40	0.30-0.51
Higher than Year 12	1186	0.57	0.49-0.65

Section 4 Results and Interpretation

Table 4-16 Sensitivity analysis - aggregation using income categories estimates (over 5 years)

	Lower confidence interval		Average WTP		Upper confidence interval	
	Main estimate	Sensitivity analysis	Main estimate	Sensitivity analysis	Main estimate	Sensitivity analysis
50% recovery						
Total household WTP for % increase ($m over 5 years)	159.4	116.1	185.3	161.9	207.6	208.1
70% recovery						
Total household WTP for % increase ($m over 5 years)	224.4	163.6	261.0	227.9	292.3	293.1
90% recovery						
Total household WTP for % increase ($m over 5 years)	289.5	211.0	336.6	294.0	377.0	378.0

Using income category WTP estimates for the aggregation results in a widening of the confidence interval, with a 10% decrease in the lower bound figure. The upper bound remains and the mean WTP vary by about 3% (downwards for the mean WTP and upwards for the upper bound WTP). However, as noted above, the combination of low estimates is not directly comparable to the main estimate, from a statistical point of view.

Table 4-17 Sensitivity analysis - aggregation using education categories estimates (over 5 years)

	Lower confidence interval		Average WTP		Upper confidence interval	
	Main estimate	Sensitivity analysis	Main estimate	Sensitivity analysis	Main estimate	Sensitivity analysis
50% recovery						
Total household WTP for % increase ($m over 5 years)	159.4	144.9	185.3	178.8	207.6	213.8
70% recovery						
Total household WTP for % increase ($m over 5 years)	224.4	204.1	261.0	251.8	292.3	301.1
90% recovery						
Total household WTP for % increase ($m over 5 years)	289.5	263.2	336.6	324.7	377.0	388.3

The impact of using education category WTP estimates for the aggregation is a widening of the confidence interval, with a significant decrease in the lower bound figure. On the other hand, the upper bound remains practically unchanged. The mean WTP drops by about 13%. However, the combination of low estimates is not directly comparable to the main estimate from a statistical point of view and only provides some valuable estimates for any sensitivity analysis.

Conclusion Section 5

The concern that the stock of televisions and computers is increasing appears to be confirmed by the results of the survey conducted as part of this study. Based on the responses of respondents, Australian households have accumulated a large number of televisions and computers – almost seven items per household. The vast majority of households have both a television and a computer, and are likely to buy another of each within the next five years. Not all replaced items go directly to landfill, with many being given away; however, this can be considered as a transitional step and a simple timing difference, as ultimately any item given away (or stored) will have to be disposed of.

5.1 Experimental design

Prior research (R&Z Consulting, 2008b) expanded on the reasons for using a Stated Preference methodology and specifically Choice Modelling to estimate the un-priced utility that households may derive from the existence of a recycling scheme for televisions and computers. The Choice Modelling methodology, when applied with rigor, allows the calculation of estimates for such values that should be included in Benefit Cost Analyses for recycling schemes.

The question central to the survey was the elicitation of the WTP for recycling those items once they had reached the end of their useful life. A lot of attention was given to the development of the Choice Modelling experiment in order to reduce the risk of respondents misunderstanding the questions put to them and therefore obtaining skewed results. Focus groups produced fruitful insights into the level of information and the nature of information that respondents considered necessary and appropriate. The format as well as the content of the informative sections of the survey were modified according to this first-hand debrief with a focus on bringing every respondent to the same level of knowledge with regard to recycling. Particular attention was given to the wording on the information provided, so that only factual and undisputed information was presented to avoid leading respondents one way or another by overemphasising the importance of waste related issues.

To introduce the WTP question, a series of attitudinal questions were first asked in order to “frame” the issue or recycling electronic good for respondents, and gain a qualitative understanding of the respondents’ mindset. The responses to the attitudinal questions asked indicate strong support for recycling within the wider community.

The design of the Choice Modelling questions was made as unambiguous as possible, but also easy to understand and respond to, so that trade-off choices could be made easily within the scenarios proposed. The appropriateness of attributes and of the level of these attributes was tested in focus groups. An important point for the success of the survey was that the scenarios should be considered realistic and that people should really believe that they would have to pay the amount indicated. Feed-back provided during the focus groups and additional testing through a pilot survey determined that this was the case and allowed for fine-tuning of this important section of the questionnaire, enhancing the robustness of the process. Additionally, follow-up questions were asked in the survey to determine whether respondents had indeed considered that the proposed scenarios were valid and realistic propositions.

5.2 Analysis

As described in Section 4.6.3, the robustness of the statistical models constructed to analyse the results was supported by their internal consistency. Key statistical parameters for the models per city and overall model were good with high levels of statistical significance associated with the standard deviations on the random parameters and the error component.

Section 5 Conclusion

The representativeness of the sample was assessed and was found to be very good, except for some misalignment in some income category levels and education levels, which led to undertaking some additional analysis and providing some additional WTP estimates to be used for sensitivity analysis.

5.3 Aggregated results

As the analysis provided satisfactory results, the individual estimates of WTP could be validly aggregated to the whole of the population of the cities included in the sample.

The support of the respondents for recycling schemes is illustrated by the WTP derived from the Choice Modelling survey. The average household in the selected cities would be willing to pay between $18 and $27 per item for an increase in the recycling rate to 50 percent (from the current level of around 1 per cent), and between $33 and $50 for an increase to 90 percent. Aggregating this to the whole of the study population (the households in Sydney, Melbourne, Adelaide, Perth and Brisbane), gives the following estimated total WTP (considering a 95% interval):

- For an increase in the recovery rate to 50 percent: $137.5 – $207.6 million;
- For an increase in the recovery rate to 70 percent: $193.7 - $292.3 million; and
- For an increase in the recovery rate to 90 percent: $249.8 - $377 million.

Households would also be willing to pay an additional premium for a kerb-side collection method of the waste, as it is presumably seen as more convenient. The range of estimates is wider than the above: $7.8 - $44.7 million, with a mean of $23-26 million.

5.4 Use of these results

These estimates provide an indication of the non-market benefits of setting up a scheme capable of achieving the above recycling rates and can be used to inform benefit cost analysis (BCA) and associated regulatory impact statements (RIS) for recycling schemes. The estimates are robust and are not statistically significantly different between cities. However, the estimates were produced using a sample population derived entirely from major cities, hence ensuring a significant coverage of the overall Australian population. It should however be kept in mind that WTP in other areas may be different.

Another essential point is that while WTP has been calculated for incremental percentages of recycling, results should only be extrapolated for levels of recycling within the boundaries of the percentage presented to the respondents in this study, i.e. above 50% of recycling only.

It is recommended that sensitivity analysis of those variables that were found to be slightly misaligned with the general population (education and income) be conducted using the additional WTP estimates provided in this report as part of a BCA. These figures provide high and low estimates which can enhance the robustness of such a study.

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Limitations

Section 7

URS Australia Pty Ltd (URS) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Environment Protection and Heritage Council and only those third parties who have been authorised in writing by URS to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Proposal dated 20 October 2008.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared between 1 February 2009 and 23 June 2009 and is based on the information available at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

Final Questionnaire

Appendix A

Final Questionnaire Appendix A

We want to know your views on how we deal with waste, particularly the recycling of worn out (unusable) TVs and computers.

Your answers to the questions that follow will help to determine how Australia may deal with recycling worn out TVs and computers.

We thank you for taking the time to answer these questions as accurately as possible. The questionnaire will take about 15 minutes to complete.

Your answers will be treated confidentially.

1) What is your gender?

- Male
- Female

2) What is your age (in years)?

- Under 18
- 18 to 34
- 35 to 44
- 45 to 54
- 55 plus

3) What is your postcode?

4) Please indicate your approximate total household income range ($/year) (before taxes) earned last year.

Select one only

- Under $13,000
- $13,000 - $25,999
- $26,000 - $33,799
- $33,800 - $41,599
- $41,600 - $51,999
- $52,000 - $62,399
- $62,400 - $72,799
- $72,800 - $88,399
- $88,400 - $103,999
- $104,000 - $129,999
- $130,000 - $155,999
- $156,000 or more
- Don't know

Appendix A Final Questionnaire

5) Thinking about dealing with household waste, which of the following statements best describes your opinion?

Tick one box only

- I never think about it
- I pay the Council for rubbish collection and it is up to them to manage it
- It is a big problem as nobody wants landfill in their neighbourhood and it takes up a lot of space
- Our society is generating too much waste which represents a drain on the resources available for future generations
- Other, please specify...

6) Please rank all the following potential issues of dealing with household waste from 1 to 5 by order of importance, where 1 is most important and 5 is least important.

- Landfill space is running out
- Avoiding having landfill in my neighbourhood
- Landfill sites are posing a threat to the natural environment
- Landfill sites are posing a threat to human health
- We risk running out of resources while sending some valuable materials to landfill
- None of them are important or relevant to me

Background to recycling

A definition:

Recycling is the reprocessing of materials and products so they can be remanufactured into new products.

It is different from reuse. That is when existing products and components are used for the same purpose, perhaps after being repaired.

7) Which of the following statements about recycling best describes your opinion?
Tick one box only

- It is a waste of time
- I do it because I have to
- I put whatever is easy to separate and handle into the recycling bin
- I put a lot of effort into recycling as I think it is a very good thing to cut down on waste
- It is too costly
- I recycle as much as I can and would like to see additional recycling systems put in place for the items that cannot currently be recycled or reused.
- Other, please specify

8) Does your household have a recycling bin(s)?
http://survey2.opinionworld.com/scripts/dubinterviewer.dll/Q4A

- Yes
- No

9) What materials do you currently put in the recycling bin?

10) What other recycling do you undertake?

TVs and computers in Australia

- According to Australian Bureau of Statistics figures, there are around 8.1 million households in Australia.
- Over 99% of Australian households have at least one television and on average each household owns 2.3 televisions.
- Sales of TVs are increasing at 3.5% per annum.
- Over 70% of households have a computer and some households have more than one.
- Sales of computers are increasing at a rate of around 17% per annum.

11) How many TV sets does your household own (including worn out TV sets)?

12) How many computers does your household own (including worn out computers, but excluding any provided by your employer)?

Background to recycling TVs and computers

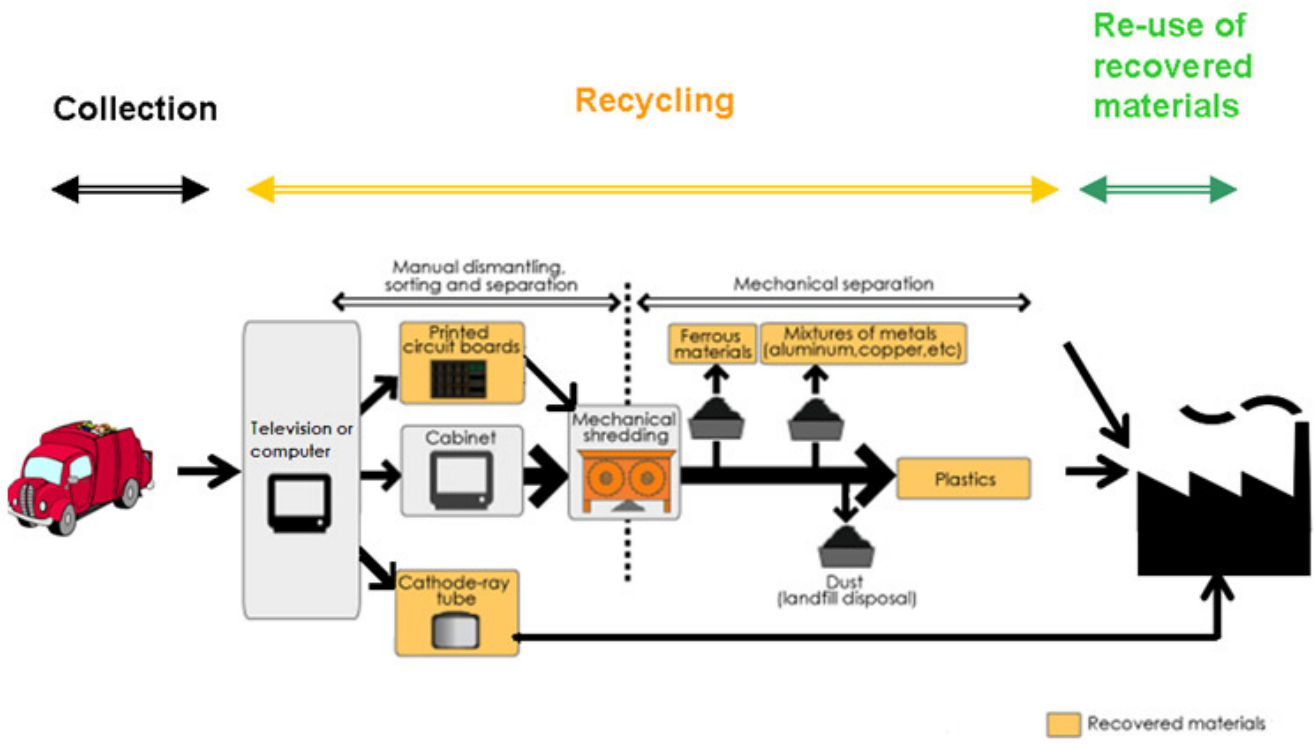
- Australian commercial recyclers are able to recover and recycle almost all of the materials from TVs and computers.
- In most cases the overall cost of recycling is currently higher than the resale price of the materials recovered.
- This means that at the moment recyclers need funds from another source to cover all the costs of picking up and recycling TVs and computers

There are two main steps in the recycling process.

Collection	• Around 1% of worn out TVs and computers in Australia are collected from households for recycling. • Worn out TVs and computers not collected for recycling go to landfill.
Resource recovery	• The amount of resources recovered from a worn out TV/computer varies depending on the complexity of the recycling process. • TVs and computers contain many different materials. The main ones are glass, plastics, steel and other metals. • TVs and computers also contain hazardous but re-useable materials such as lead, mercury and cadmium. Most of these hazardous materials cannot be recovered without going through a more complex and thus more costly recycling process.

Appendix A Final Questionnaire

The recycling of a TV/Computer (example)



Why recycle TVs and computers?

Some of the reasons why you may want to recycle worn out TVs and computers are given below.

You may or may not share these views.

Reason	Quick info
Reduced use of landfill space	Approximately 1.5 million TVs and 2 million computers are disposed of in Australia every year (computers tend to get obsolete more quickly). This is about 40,000 tonnes and 38,000 tonnes respectively and 1% of all household waste by weight. If 75% of the TV sets and computers disposed of annually were recycled, up to 320,000 cubic meters of landfill space could be saved. This is the equivalent of 128 Olympic swimming pools in volume.
Recovery of materials	Recycling materials from Cathode Ray Tube screens allows the recovery of up to 10-20kg glass, 5kg of plastic, 1kg of copper and similar quantities of lead and other metals per screen. Recycling flat panel screens gives less glass and lead but more plastic and other metals. For example, a desktop hard drive contains a high proportion (around 80%) of recyclable aluminium.

Why are TVs and computers not currently recycled?

Here are some reasons why some worn out TVs and computers are not currently recycled.
Again, you may or may not share these views.

Reason	Quick info
Technical	While it is relatively simple to recover plastics, clear glass and wires, recovering other materials, such as the lead in Cathode Ray Tubes or recycling batteries is more difficult.
Organisational	Arrangements would need to be put in place to collect and transport millions of units from all over Australia, including rural areas, to recycling facilities.
Cost	Currently the overall costs of recycling are higher than the resale price of the materials recovered from recycling. This means that at the moment recyclers need funds from a source other than the recovered materials to cover all the costs of picking up and recycling TVs and computers.

13) How many worn out TV sets have you disposed of in the last two years?

14) How did you dispose of it/them?

Please write in the relevant box the number of TVs disposed of through each of the following methods

Sold it	
Gave it away	
Traded it in	
Took it to a recycling facility	
Left it in front of the house for someone to collect	
Took it to the tip	
Left it for normal rubbish collection	
Left it for kerbside rubbish collection	
It was collected by the store that sold me my replacement TV	

Appendix A Final Questionnaire

15) How many of the following worn out items have you disposed of in the last two years?

Computer monitors	
Central processing unit	
Laptop	

16) How did you dispose of it/them?

Please write in the relevant box the number of units disposed of through each of the following methods

Sold it	
Gave it away	
Traded it in	
Took it to a recycling facility	
Left it in front of the house for someone to collect	
Took it to the tip	
Left it for normal rubbish collection	
Left it for kerbside collection	

17) In the next five years, how many new TV(s) and computer(s) (both desk top and laptop) do you expect your household to buy?

TVs	
Computers	

Final Questionnaire Appendix A

The next six questions will ask you about the type of recycling scheme for worn out TVs and computers that you would prefer if such a scheme were introduced and what you would be prepared to pay for it. [13]

A number of alternative schemes are described in terms of :

- The reduction in TVs/computers going to landfill as waste and the percentage of material recovery from the recycling process
- The way worn out TVs / computers would be collected from households
- What it would cost you, compared to the current situation

All the schemes described in this survey would be funded by incorporating the cost of recycling in the price of each new TV/computer you buy.

- When making your choices in the next six questions, remember that if you choose a new recycling scheme, you will have to pay an additional cost for each new computer and TV that you purchase. Your payment will help fund the new recycling scheme.
- Please answer each separate question as though the recycling schemes presented on that page are the only ones available.
- Remember how much money you have to spend and your other financial commitments.
- In each of the next six questions, you will always be able to choose to stay with the current arrangements and not pay anything more.

The different collection methods in the schemes are:

Kerbside	You leave the worn out TV or computer on the kerb outside your house on special days (not as often as current rubbish collection) and it is collected.
Drop-off	You drop off the worn out TV or computer to a local collection centre (which would be no more than, say, 5 km from your house).
Current collection method	It varies from location to location. No organised or unified collection method.

[13] Note that the 6 choice sets presented here only represent one “block” of the experimental design. The full experimental design is described in 3.4.3 in the body of the report.

Appendix A Final Questionnaire

18) Please select the recycling scheme you prefer

Roll your mouse over a collection method to view its description

Percentage of waste avoided and material recovered	Collection method	Additional cost on each new TV / computer purchased	Your choice (select one)
90%	Kerbside	$40 per item	
50%	Drop-off	$20 per item	
1%	Current collection method	$0 per item	

19) Please select the recycling scheme you prefer.

Roll your mouse over a collection method to view its description

Percentage of waste avoided and material recovered	Collection method	Additional cost on each new TV / computer purchased	Your choice (select one)
90%	Kerbside	$20 per item	
50%	Kerbside	$10 per item	
1%	Current collection method	$0 per item	

20) Please select the recycling scheme you prefer.

Roll your mouse over a collection method to view its description

Percentage of waste avoided and material recovered	Collection method	Additional cost on each new TV / computer purchased	Your choice (select one)
90%	Drop-off	$20 per item	
70%	Kerbside	$40 per item	
1%	Current collection method	$0 per item	

21) Please select the recycling scheme you prefer.

Roll your mouse over a collection method to view its description

Percentage of waste avoided and material recovered	Collection method	Additional cost on each new TV / computer purchased	Your choice (select one)
50%	Kerbside	$40 per item	
90%	Drop-off	$60 per item	
1%	Current collection method	$0 per item	

22) Please select the recycling scheme you prefer.

Roll your mouse over a collection method to view its description

Percentage of waste avoided and material recovered	Collection method	Additional cost on each new TV / computer purchased	Your choice (select one)
50%	Kerbside	$60 per item	
70%	Drop-off	$60 per item	
1%	Current collection method	$0 per item	

23) Please select the recycling scheme you prefer.

Roll your mouse over a collection method to view its description

Percentage of waste avoided and material recovered	Collection method	Additional cost on each new TV / computer purchased	Your choice (select one)
70%	Drop-of	$40 per item	
50%	Kerbside	$10 per item	
1%	Current collection method	$0 per item	

Appendix A Final Questionnaire

24) In the previous questions, you chose to pay for a recycling scheme, at least sometimes. What were your main reasons for choosing a new recycling scheme?

Please select all that apply from the list below.

We need to conserve resources for future generations	
I like supporting a good cause	
People should bear the full cost of their consumption decisions	
I want to reduce the amount of waste going to landfill	
Recycling TVs and computers is an important issue for me	
I am concerned about the hazardous materials contained in TVs and computers	
I don't believe I will really have to pay any extra amount	
Other (please state)	

25) In the previous questions, you chose to pay for a recycling scheme, at least sometimes. What were your main reasons for choosing a new recycling scheme?
Please select all that apply from the list below.

I am concerned about the hazardous materials contained in TVs and computers	
I want to reduce the amount of waste going to landfill	
People should bear the full cost of their consumption decisions	
I don't believe I will really have to pay any extra amount	
We need to conserve resources for future generations	
Recycling TVs and computers is an important issue for me	
I like supporting a good cause	
Other (please state	

26) Please indicate which of the following characteristics you ignored when making your choices in the previous questions

Select as many as apply

None, I considered all characteristics equally	
Collection method	
Percentage of waste recovered	
Cost	

27) Which category best describes your household?

Single person household	
Shared house	
Couple without children	
Family	
Other (Please describe)	

28) What category best describes the place where you live?

House	
Townhouse	
Unit/apartment	

Appendix A Final Questionnaire

29) What is the highest level of education you have obtained?
Select one only

Never went to school	
Primary (Year 6 or less)	
Year 10 or less	
Year 12 or less	
Diploma or Certificate	
Tertiary degree	
Postgraduate degree	
Other (please specify)	

Thank you very much for being part of this survey.

If there are other comments you'd like to make please do so here:

Finally, we would like to ask your opinion about this survey

29) **Did you enjoy taking this survey?**
1 being 'not at all' 5 being 'I enjoyed it very much'

	1	2	3	4	5	
Not at all	❍	❍	❍	❍	❍	I enjoyed it very much

31) **How likely are you to participate in the next survey?**
1 being 'very unlikely and 5 being 'very likely'

	1	2	3	4	5	
Not at all	❍	❍	❍	❍	❍	I enjoyed it very much

32) **Did you notice anything you thought was strange, poorly written or explained, annoying etc. in the survey?**

Survey Quotas

Appendix B

Survey Quotas

Appendix B

CITY	Income level	Age / Sex	Target quota	Quota achieved	Over quota
Adelaide (SA)	Low (below median)	Males 18 - 34	24	24	0
		Males 35 - 44	8	10	2
		Males 45 - 54	7	7	0
		Males 55 +	28	30	2
		Females 18 - 34	24	21	-3
		Females 35 - 44	8	9	1
		Females 45 - 54	7	8	1
		Females 55 +	28	29	1
		Total	135	138	4
	High (above median)	Males 18 - 34	20	22	2
		Males 35 - 44	16	16	0
		Males 45 - 54	16	16	0
		Males 55 +	15	17	2
		Females 18 - 34	20	17	-3
		Females 35 - 44	16	18	2
		Females 45 - 54	16	17	1
		Females 55 +	15	16	1
		Total	134	139	5
	Don't know/Prefer not to state	Males 18 - 34	5	5	0
		Males 35 - 44	3	0	-3
		Males 45 - 54	3	2	-1
		Males 55 +	5	5	0
		Females 18 - 34	5	5	0
		Females 35 - 44	3	2	-1
		Females 45 - 54	3	4	1
		Females 55 +	5	5	0
		Total	32	28	-4
Brisbane (QLD)	Low	Males 18 - 34	27	25	-2
		Males 35 - 44	9	9	0
		Males 45 - 54	8	9	1
		Males 55 +	24	24	0
		Females 18 - 34	27	36	9
		Females 35 - 44	9	9	0
		Females 45 - 54	8	9	1
		Females 55 +	24	24	0
		Total	136	145	9
	High	Males 18 - 34	23	24	1
		Males 35 - 44	17	14	-3
		Males 45 - 54	15	15	0
		Males 55 +	13	12	-1

Appendix B Survey Quotas

CITY	Income level	Age / Sex	Target quota	Quota achieved	Over quota
		Females 18 - 34	23	31	8
		Females 35 - 44	17	16	-1
		Females 45 - 54	15	16	1
		Females 55 +	13	6	-7
		Total	136	134	-2
	Don't know/Prefer not to state	Males 18 - 34	5	5	0
		Males 35 - 44	3	1	-2
		Males 45 - 54	3	3	0
		Males 55 +	4	4	0
		Females 18 - 34	5	7	2
		Females 35 - 44	3	1	-2
		Females 45 - 54	3	3	0
		Females 55 +	4	4	0
		Total	30	28	-2
Melbourne (VIC)	Low	Males 18 - 34	52	46	-6
		Males 35 - 44	18	18	0
		Males 45 - 54	15	16	1
		Males 55 +	49	55	6
		Females 18 - 34	52	51	-1
		Females 35 - 44	18	18	0
		Females 45 - 54	15	16	1
		Females 55 +	49	54	5
		Total	268	274	6
	High	Males 18 - 34	45	47	2
		Males 35 - 44	35	28	-7
		Males 45 - 54	30	32	2
		Males 55 +	26	29	3
		Females 18 - 34	45	39	-6
		Females 35 - 44	35	35	0
		Females 45 - 54	30	29	-1
		Females 55 +	26	28	2
		Total	272	267	-5
	Don't know/Prefer not to state	Males 18 - 34	11	9	-2
		Males 35 - 44	5	2	-3
		Males 45 - 54	5	6	1
		Males 55 +	8	9	1
		Females 18 - 34	11	11	0
		Females 35 - 44	5	6	1
		Females 45 - 54	5	6	1
		Females 55 +	8	10	2
		Total	58	59	1

Survey Quotas

Appendix B

CITY	Income level	Age / Sex	Target quota	Quota achieved	Over quota
Perth (WA)	Low	Males 18 - 34	25	25	0
		Males 35 - 44	9	8	-1
		Males 45 - 54	8	7	-1
		Males 55 +	25	27	2
		Females 18 - 34	25	28	3
		Females 35 - 44	9	9	0
		Females 45 - 54	8	8	0
		Females 55 +	25	27	2
		Total	134	139	5
	High	Males 18 - 34	22	21	-1
		Males 35 - 44	16	13	-3
		Males 45 - 54	16	18	2
		Males 55 +	14	15	1
		Females 18 - 34	22	24	2
		Females 35 - 44	16	16	0
		Females 45 - 54	16	17	1
		Females 55 +	14	13	-1
		Total	136	137	1
	Don't know/Prefer not to state	Males 18 - 34	5	5	0
		Males 35 - 44	3	2	-1
		Males 45 - 54	3	2	-1
		Males 55 +	5	4	-1
		Females 18 - 34	5	6	1
		Females 35 - 44	3	3	0
		Females 45 - 54	3	3	0
		Females 55 +	5	4	-1
		Total	32	29	-3
Sydney (NSW)	Low	Males 18 - 34	45	39	-6
		Males 35 - 44	20	19	-1
		Males 45 - 54	18	13	-5
		Males 55 +	52	51	-1
		Females 18 - 34	45	37	-8
		Females 35 - 44	20	16	-4
		Females 45 - 54	18	15	-3
		Females 55 +	52	45	-7
		Total	270	235	-35
	High	Males 18 - 34	45	46	1
		Males 35 - 44	34	32	-2
		Males 45 - 54	30	33	3
		Males 55 +	26	32	6
		Females 18 - 34	45	50	5

Appendix B Survey Quotas

CITY	Income level	Age / Sex	Target quota	Quota achieved	Over quota
		Females 35 - 44	34	36	2
		Females 45 - 54	30	35	5
		Females 55 +	26	37	11
		Total	270	301	31
	Don't know/Prefer not to state	Males 18 - 34	10	7	-3
		Males 35 - 44	6	3	-3
		Males 45 - 54	5	3	-2
		Males 55 +	9	7	-2
		Females 18 - 34	10	11	1
		Females 35 - 44	6	6	0
		Females 45 - 54	5	5	0
		Females 55 +	9	10	1
		Total	60	52	-8
TOTAL	Low	Males 18 - 34	173	159	-14
		Males 35 - 44	65	64	-1
		Males 45 - 54	57	52	-5
		Males 55 +	177	187	10
		Females 18 - 34	173	173	0
		Females 35 - 44	65	61	-4
		Females 45 - 54	57	56	-1
		Females 55 +	177	179	2
		Total	944	931	-13
	High	Males 18 - 34	154	160	6
		Males 35 - 44	118	103	-15
		Males 45 - 54	108	114	6
		Males 55 +	95	105	10
		Females 18 - 34	154	161	7
		Females 35 - 44	118	121	3
		Females 45 - 54	108	114	6
		Females 55 +	95	100	5
		Total	950	978	28
	Don't know/Prefer not to state	Males 18 - 34	36	31	-5
		Males 35 - 44	20	8	-12
		Males 45 - 54	19	16	-3
		Males 55 +	30	29	-1
		Females 18 - 34	36	40	4
		Females 35 - 44	20	18	-2
		Females 45 - 54	19	21	2
		Females 55 +	30	33	3
		Total	210	196	-14

Summary of Focus Group Discussions

Appendix C

Summary of Focus Group Discussions Appendix C

Below are the summaries of the discussions held during the six focus groups organised to test successive versions of the questionnaire and gain some understanding about people's thinking around e-waste. The questionnaire was amended after virtually each focus group (except for Sydney, where two groups were held on the same night) to reflects comments and feedback.

Summaries have been kept as consistent as possible.

C.1 Sydney Focus Group 1

Held on: 25/11/08 - Session 1 – 4:30 - 6:30pm

Attendees:

- Jean, Janice, Donald, Jan, Chris, Rhonda, Dennis and Graham
- 5 women and 3 men
- 50+ age group and mixed income and education levels

About recycling:

- People pinch recycling bin (glass and tin). Collected every week. All recycling in the same bin – not separated.
- Little recycling bins, but would prefer a larger wheelie bin for recyclables. Recycling is collected regularly.
- Recycling is collected separately from normal rubbish. Not sure why recycling is not separated when it is collected – it all goes into the one truck. Noticed that his suburb was very untidy after the recent wind because recycling is in bins (not wheelie bins). Visits a number of recycling plants for his work.
- Recycling is collected in wheelie bins for glass and paper. Paper is collected one week and glass the following week.
- Concerned that recycling is not separated.
- No complaints. The recycling in my suburb works well.
- There's separation of recyclables. Thinks that recycling could be extended to include green waste. Recycling has changed over time. Recycling is collected by the council, but he's not sure what happens to it after it is collected.
- Lives in a unit block. There are wheelie bins for recycling for all residents in the basement. There are different wheelie bins for different materials. The council has started to charge residents for replacement recycling bins.
- Not enough recycling happens.
- Think plastic bags should no longer be used
- Not sure if there is a problem with the current level of recycling because she doesn't have much to recycle.

Does it cost the council to provide a recycling service, or does it make money from it?

Consensus around the fact that it costs the council.

Disposing of televisions and Computers:

There were a number of responses when members were asked to describe how they disposed of televisions and Computers:

Appendix C Summary of Focus Group Discussions

- Kept them.
- Gave them to relatives.
- Called the council and arranged for collection (often the items are taken by passers-by before the council collects them).
- Computer technician disposed of it on my behalf.
- Tried to donate to charity, but couldn't find one that was convenient.
- It's frequently cheaper not to try to recycle.
- People don't care about recycling, so they don't bother.

Who should pay for recycling?

A variety of responses were given when members were asked:

- Suppliers should contribute.
- Consumers should pay when they buy appliances.
- When an item has reached the end of its life, I don't want to spend more money on it. If people had to pay to have it recycled, there would be an increase in illegal dumping. Most companies will collect for a fee.
- Recycling is only done when it doesn't cost money.

What about a council fee for recycling?

- There would be an uproar.
- One-person households shouldn't have to cross-subsidise larger households.
- We currently pay a fee on our rates for recycling.
- I wouldn't mind paying for it if was shown on my rates notice as a separate item.

Characteristics of a Recycling Scheme:

A recycling scheme should have the following attributes:

- Central collection point that divides waste into useful parts and non-useful parts
- Needs to communicate why televisions and Computers need special treatment
- Needs to communicate the economics and risks associated with and without recycling.

About the survey:

There was a mixed response to the question about whether members would do the survey if they received the email. Some said yes, without qualification. Others said yes, providing it came at a convenient time.

Others said no because:

- the preamble (p11 definitions) was too complicated and hard to remember the definitions (had to keep going back to them)
- last option should have allowed us to select none [subsequently corrected]
- There was enough information, but it was confusing.
- The first section should include better instructions about what needs to be done [subsequently corrected]
- Question 2 – it was difficult to answer this question because I didn't know if the statements were true.

Summary of Focus Group Discussions Appendix C

Are landfill sites safe?

- Nothing could convince me that they are safe. To know if they were safe, you would have to know what's going into them.
- Skeptical because of previous experience of how they are managed.
- Too many toxic elements in machines (eg. Fluorescent lightbulbs) to be safe.

About the proposed scenarios:

- Found it quite confusing. Had to keep going back to p11 definitions.
- All attributes were important.
- Could see why a deposit-refund would be viable
- Difficult to answer, because I had already formulated my own opinions about what would work and this was not represented in the scenarios.
- Only interested in scenarios that included a product-levy.
- Only interested in scenarios with a fee on deposit.
- Couldn't understand p19 (fee on disposal) – why would you pay more for less recycling
- It was confusing, but I used all columns. There was enough information, but I had to keep going back to p11.
- Question 3 was confusing. I didn't believe any of the statements. Is it asking what I currently do, or is it asking what I would rather do? It's ambiguous.
- Question 11 was easy, but it involved a guess.
- Question 11 was hard, because I'm not sure whether e-waste recycling is currently possible, or will be possible before I want to dispose of my televisions and computers.
- Question 11 requires a guess about whether my television and computer will become redundant (before they have become worn out).

What about the different recycling payment options?

- Deposit – refund scheme works well for bottles in SA, but I wouldn't like to see it for televisions and computers. I don't trust that I would get my money back and it would involve too much administration
- I think it should be a pay-to-use service. Don't put it on the council rates.
- I like the current hard waste collection service offered by the North Sydney council. You could combine this with a pay-per-use by having to quote your rate reference number when you request collection.

What about the cost?

- $100 would be too much
- $50 would be too much
- I would pay $20
- I wouldn't pay $20
- I would pay it if I could be sure that I'm not already paying for it.
- It should reflect the cost. I need more information about how much it costs before I can say what I would be willing to pay.
- The prices are wrong because they don't take account of relative budgets.

What would you get out of recycling?

- I would get rid of the items. I'm not too worried about whether it's recycled
- I would feel comfortable paying for it, if each council provided information about how it was going to be recycled. (general agreement that the council couldn't be trusted)
- I would recycle for altruistic reasons – for the greater good of humanity.

Appendix C Summary of Focus Group Discussions

Other comments?

- Why do we need to know income? I would not answer it if I received an invitation to do the survey.
- I think you need to be careful about making a correlation between the response and the income.
- I would rather have the cost on my council rates than pay a waste tax.
- I like the idea of the cost being included by the manufacturers because it's a one-off payment at the time of sale. I like to take direct responsibility because people can make a decision about whether they can afford it.

Summary:

- There wasn't a great deal of awareness about why we might want to recycle televisions and computers. Members didn't know why they should be considered specially.
- There wasn't a great deal of awareness of what recycling means beyond how it is collected.

⇨ Many responded saying that a recycling scheme would need to include information about how it works and why it's needed. This was consistent with comments about the need for more information within the survey documentation.

- There was a mixed response to what people get from recycling. One person said it was for the greater good of humanity. Others said that they were just happy to get rid of the items they no longer needed.
- Seemed to be support for a product levy, although some considered that a council rate would be reasonable if enough information was provided.
- Seemed to be support for the most convenient collection method.

C.2 Sydney Focus Group 2

Held on: 25/11/08 - Session 2 – 7:00 – 9:00pm

Attendees:

- Charlie, Jacqui, Melanie, Michael, Hugh, Craig, Jenny
- 3 women and 4 men
- ½ 18-34 and ½ 35 - 49 age group, mixed income and education levels

Practice and knowledge of recycling:

- I live in a high rise building with a garbage chute. I recycle and am more inclined to as time goes by.
- I need to keep my recycling in my apartment until I deposit it in the garage. It is collected once per week by the council.
- I live in a terrace house and take a recycling crate down to the kerb once per week.
- It seems to work reasonably well. I'm not sure which plastics can be recycled.
- I live with housemates, but they're not clear on what's recyclable.
- I live in a townhouse and recycle.
- I live in a terrace house and am religious about recycling. My recycling crate is collected by a contractor.

Is there enough recycling:

- Could be more recycling – in terms of number of people recycling and the number of products being recycled.
- There is enough recycling of some products and not of others. We should try to get more out of appliances that are not worn out, but no longer required.
- I want manufacturers to take responsibility for packaging
- I wear recycled clothing and I like to fix things rather than replacing.
- How many things can be recycled?
- I want feedback on what's happening with recycling.
- What about restricting how manufacturers can package products?

Summary of Focus Group Discussions

Appendix C

Do you think the council makes money?

- Yes, it makes money.
- The council shouldn't make money.

Disposing of televisions, computers and monitors:

- I took a computer to the dump.
- The council collected the television and took it away. I don't know what happened after that.
- I put an old television on the street.
- I looked for a company to recycle a computer. I would prefer that it doesn't go to landfill because I'm worried about the environmental effects.
- Don't know what to do with (my computer/television). I'm holding on to it until I can find where to recycle it. I'm worried about the energy intensity embodied in products.
- I don't want to throw my computers and televisions away because they're still working, but I don't need them.
- I give them away rather than throw them out.

Who should pay?

- Some people just dump them, but I would rather manufacturers pay.
- I'm more interested in recycling being user-pays, because it encourages people to think about what they buy.
- If it's in the rates, I might forget about it and still dump them when they're wornout.
- (The deposit-refund scheme) Wouldn't work because the company may not be around in 15 years time.

What is recycling?:

- Not sure how they would recycle televisions and computers.
- Recycling involves biological processes, but it's hard to know how televisions and computers would be recycled.
- Products should be designed to be disassembled at the end of its life.
- Recycling is breaking down a product into components and then reusing each component.

Recycling scheme characteristics:

- Want to know what to do with unwanted waste.
- Council should facilitate collection and recycling.
- Organisations that redistribute to people who need them should be included.
- Should be up-front, mandatory and all brands.
- Should include drop-off points throughout the city.
- Want to know what recycling means.

In the exercise just completed:

How did it go?

- I wouldn't have read the longer sections of the text.
- Difficult to remember definitions. Should have them on each page.
- Too much information to remember.
- I like p11 (definitions). It needs more context, e.g. "this will help you to answer the next questions".
- No one reads instructions.
- I would have more trouble if it were on a computer. It took a lot of energy to fill in because it was slightly confusing. It raised things that I haven't thought about previously.
- It was alright. The questions should be straight down the line, i.e. how much would you pay?

Appendix C Summary of Focus Group Discussions

How did you go about making your choices?

- I didn't read through anything else but the % recycled.
- I used all attributes.
- It wasn't clear who gets the benefit from the levy.
- I want to make sure that the community benefits.
- I want to make sure that the most % possible is recycled.
- I used the % of waste recycled and other factors as they suited me. I'm looking for convenience, e.g. kerb-side collection.
- Cost was important to me.
- It would be better if you could provide context, e.g if you purchase a $1000 television…
- I laboured over all of the detail and didn't skip anything.
- I used % recycled, then recycling scheme, then cost to decide.
- I chose based on what's best for me.
- I chose to stick with the status quo.

Was there any bias?

- No bias

Were the costs reasonable?

- $50 was too much – general agreement.

What did you get from your payment?

- I thought about waste aspect and the environmental aspect. I hoped I would get a better way.
- Less pollution, helping the environment.
- Less wasted resources.
- Want to know that I'm doing the right thing.

Would you believe me if I said landfill is safe?

- I think there's still an environmental effect.
- There is an adverse effect.
- Lifecycle analysis should be considered. If the carbon footprint is higher from recycling, I would say just put it in the dump.

How did you find Question 11?

- It was hard, so I guessed.
- I think you should separate televisions and computers.

What if it was achieved through a flat fee? User pays? Waste levy?

- Wide support – we do it for tyres already.
- I would support a user pays approach.
- I wouldn't mind a waste levy.

Questions 19 – 26?

- These questions were okay. No major problems.
- What's the difference between an apartment and a unit?

Summary of Focus Group Discussions Appendix C

Summary:

- Responses were driven by convenience, although a number considered only the % recycled in making their decision.
- People thought their payments were buying better environmental outcomes (fewer resources, reduced waste), clearer consciences, a sense of doing the right thing.
- Widespread distrust of landfill.
- Want more information about recycling – what can be recycled, what happens after it is collected.

C.3 Melbourne CBD Focus Group

Held on: 01/12/08 – 7-9 pm

Attendees:

- Craig, Alexander, Robyn, Sandy, Anneli, Nick, Adrian
- 3 drop-offs
- 2 women, 5 men, mix of age groups, education and income

NB: There was a clear socio-demographic split of the population: from very environmentally aware are prepared to contribute (in terms of inconvenience and cost) to mainly convenience oriented and cost-conscious.

Facilitation: Lili Pechey and Christophe Brulliard

About recycling:

- Recycling may have some negative environmental impacts too,
- Data security issue with computers (what personal information can be retrieved, etc),
- Content of recycling bins still sometimes ends up in landfill,
- Risk from hazardous materials,
- Running out of space and future generations responsibility,
- Resource recovery,
- Lack of knowledge about what can and can't be recycled (e.g. bottle lids), don't know where to take things,
- Not enough opportunity to recycle,
- Need to create demand for recycled goods, but recycled goods are too expensive (but reflects true cost to environment),
- Recycling paid for through council rates, knowledge and info depends on what's provided by council, renters don't see the cost.

Benefits of recycling

- Environment
- Cleanliness/tidiness
- Better quality of life for future generations
- Reduced landfill size
- Reduction in new plantations
- Fashion – inspires creativity

Drawbacks of recycling

- Organization and knowledge required
- Colours restricted (in recycled products)
- Cost of handling and separation, processing and lack of technology

Appendix C Summary of Focus Group Discussions

- Labour intensive (could also be a benefit – extra jobs)
- Possibly high environmental cost – transport, process, chemicals, resource use and byproducts

Disposing of rubbish to landfill

- Landfills seen as unsafe – e.g. methane leak at Cranbourne
- Unsightly, takes ages to break down
- Toxins enter ground, water contamination
- Depends on what the product is – paper seen as relatively harmless and biodegradable
- Also depends on what the use is once the landfill closes – don't want kids playing on it

What do you do with your old televisions/computers?

- Give away, council clean up days, charity
- Depends if item is still useable or not – sell if possible
- Can't buy recycled televisions
- Lack of trust/knowledge about how much good recycling a television is doing – need more feedback and education
- Would like to recycle all parts of a television possible
- Would like to take it back to the manufacturer – put responsibility back on manufacturer, lots of work being done on end user side, not on manufacturer side

Objectives of a recycling scheme

- Circular process
- Greater info and transparency
- Reducing toxicity, toxic materials released into environment
- Efficiency and effectiveness
- Product disclosure- what's in this television/computer (toxic materials, recycled components)
- Concern over how quickly electronics become obsolete – products should be able to be upgraded/repaired, better product design
- Concerns over security and personal info on computers
- People need motivation, need to see the results of recycling
- Need to provide info in other languages

Who should pay for a recycling scheme?

- Businesses should pay for their own recycling
- Households – need to see the cost justified. Happy to pay for it out of taxes, should be everyone's responsibility (some debate over this point, others argued that it should be a user pays system with consumers paying at point of purchase)

About the collection method:

- The convenience element and "getting the goods off your hands" is important,
- a drop-off centre, even local, may still represent a challenge with the ever increasing size of the new television screen

.

About the payment mechanism:

- Disagreement on the mechanism: some thought it could be included in council rates and applied to everybody, whereas other people supported a product levy (potentially as a % of the purchase).

About the level of information:

- The level of information present was overall judged adequate, but clearly not everybody read it
- Questionnaire was thought to be slightly pro-recycling
- Definition of recycling should go at the start

About the choice set:

- The simple choice set was found easy to comprehend and to reply to, maybe too simple, as some people did not see the point of the choices presented.
- People are able to distinguish between the attributes – toxic waste reduction, % reuse

Summary

- People felt there was not enough information provided to them by councils and other groups on recycling issues, some confusion over what can/can't be recycled
- There was general support for an e-waste recycling scheme, though debate over who should pay for it
- Questionnaire was generally well understood and received by focus group participants
- Ease of disposal seen as important for the success of a recycling scheme

C.4 Adelaide Focus Group

Held on 2/12/08 - New Focus - Marden – 7 - 9pm

Attendees:

- Grant, Gail, Athena, Fiona, Graeme, Kelly, Malcolm, Meredith, Leah
- 6 women and 3 men (1 man dropped out)
- Mixed age group, mixed income, family situation and education levels
- Facilitation: CB and LP

What is recycling?

- Reusing part of the materials that constitute a product
- Saving the need to access new raw materials
- Reusing to minimise waste for ethical reasons
- Reduce impact of toxic substances such as mercury on landfill
- Reduce landfill waste
- Look after the environment
- Apply a "cradle to grave" logic to products we are using
- Recycling is going in the right direction, but more information is needed about how to recycle e-waste

Are there enough opportunities for recycling?

- Yes for "small things" but not for "big things" (including household appliances)
- Australia is "behind" European countries, especially Germany where product stewardship is much more developed: not enough choice of responsible suppliers in Australia
- Not enough attention given to good design which allows easy recycling
- Don't know what to do with old computers
- Don't like to see old televisions dumped on the side of the road
- Not sure about what Councils that do collect old televisions do with them (and not all Councils do)
- Lack of information / education about what to do with this e-waste

Appendix C Summary of Focus Group Discussions

- Charities: only accept goods in working order that can be reused
- It's not always convenient to recycle
- Need collection points for specific items
- It should be the responsibility of manufacturers or retailers to organise recycling

What are the benefits / drawbacks of recycling (whiteboard exercise)?

Benefits	Drawbacks
Toxic products do not go to landfill	Concern about actually reusing the components
Allow to cut back on manufacturing	Could lead to "false economies", when transport and reprocessing are taken into account
Use less raw materials	Cost
Reduce carbon footprint	
Reduce potential health concerns	
Employment: could be positive / negative	

What do you think about landfills and their management?

- Show no respect for the land
- Land is a precious resource – its use should be minimised
- Landfills are not healthy places
- We don't know much about what's happening with landfills – more communication is required
- Toxic substances could leak into the water tables
- There are some issues about the cost-effectiveness of landfills that need to be communicated clearly
- Landfills have improved
- Landfills are the responsibility of the Councils
- There is a science to the management of landfill these days. They are managed quite carefully.

What would be the characteristics of a good recycling scheme (whiteboard exercise)?

- Uniformity across Councils to achieve economies of scale and increase understanding of residents
- One depot per Council and call out facility for bigger items
- Involve manufacturers to increase good design standards
- Costs should be passed to taxpayers' through council but also to manufacturers
- The whole lifecycle should be considered
- Should be rebates for recycling like for rainwater tanks and solar panels

Feedback on questionnaire:

- Quantity of information provided is good. Questionnaire length is OK.
- Some difficulties understanding the CM questions (in addition to difficulties about negative formulation of the first attribute) and why they were repeated.
- Some couldn't see how using collection depots would create an incentive to recycle, e.g. 'If I've paid the levy at the time of purchase, why should I have to drop it off at a collection depot?'

- Not everybody answered those questions, as they did not see the relevance – if recycling has a cost, the question is how to cover it, not how much.
- When queried on how they made a decision (and specifically how they assessed whether the cost was acceptable), most people admitted that they systematically went for the middle option, with a good balance of people deciding essentially on cost, where others (greener part of the population) would decide on maximum recycling.
- The two attributes (avoidance of waste going to landfill and material recovery) were seen as clearly not independent. People are however usually able to tell which of the two attributes they consider most important, and the split was roughly 50-50% in the group.
- When they were asked what they thought they were buying when expressing WTP for recycling, people talked about: clear conscience, future, light footprint and the feeling of doing something positive for the environment.

About the payment scenario

- Refund scheme would give people incentive to "go out of their way" to recycle, which a product levy does not achieve
- Council rates was considered as a possible way to collect the money (but not unanimously), although it was pointed out that only the owner not the renter pay the council rates.
- There was a near consensus that the cost should be a percentage of the value of the good purchased (1%-5%).
- There was strong support for a mandatory scheme rather than a voluntary scheme.

About the possibility of dissociating televisions and computers

- See televisions and computers as the same good (televisions can be used as computers, same LCD screens), but televisions can be virtually un-movable and longer lived.

Summary

- Level of information provided is now about right.
- Anchoring effect of the "middle" scenario is a concern which needs to be addressed.
- The 2 attributes tested are not independent, although people clearly understand the different concepts.
- The convenience aspect is still dominates the discussion and the cost is a dominant choice element.
- Payment mechanism: no conclusive preference, but levy as a percentage of the purchase cost of the good seems to be acceptable to many.

Additional insight

- Feedback mechanism: people want to know "how well" they are doing in terms of recycling. They want some measure of their effort at the same time as some guarantee / accountability about the performance of the scheme.

C.5 Melbourne Box Hill Focus Group

Held on 4/12/08 - 7 - 9pm

Attendees:

- Greg, Ann, Denise, Bill, Danny, Wendy, Richard, Ann (2), Peter ,Kaye, Dorothy
- 6 women and 5 men (no no-show)
- Older age group, mixed income, family situation and education levels
- Facilitation: CB and LP

Appendix C Summary of Focus Group Discussions

What is recycling?

- Reusing part of the materials that constitute a product
- Dealing with household waste in the most appropriate way (recycle bins)
- Avoiding to use single-use / disposable items (strongly reinforced by several participants)
- Mindset to reuse everything that is still useable
- Preventing waste
- Preventing unnecessary landfill
- Daily activity of recycling
- Recycling seems to be a costly activity in Australia (compared with overseas examples)

Concerns:

- Distrust about the level of recycling actually happening with the content of the household recycling bins – suspicion that a lot ends up in landfill anyway.

Are there enough opportunities for recycling?

- Yes for things such as paper, where the market does not seem to be able to absorb recycled products, but electrical products recycling still seems to be in its infancy.
- Not enough recycling opportunities, as Government appears to procrastinate
- Places that recondition and recycle old computers can be found.
- Some Councils organise such recycling opportunities but refuse equipment from people who do not leave within the Council boundaries.
- Polystyrene is a concerned and should be banished (as it cannot be recycled)
- Not enough re-use as well as not enough recycling. Social aspect about re-using equipment, i.e. it creates a sense of community.
- Informal recycling (leaving things in front of the house for people to pick up if they are interested) may mean that the item is weather damaged and ruined/wasted.
- There is not enough incentive for (and information about) recycling.
- There is not enough recycling but the cost of recycling should also be considered when it is not profitable to recycle.
- Not enough opportunities to dispose safely of old paints and chemical, as well as televisions and computers.
- Cost is an issue: getting rid of old tyres is expensive.

What are the benefits / drawbacks of recycling (whiteboard exercise)?

Benefits	Drawbacks
Resources conservation	Cost
Less pollution	Re-processing can cause pollution and potential health issues
Saves money	Requires commitment and effort – makes life more complicated (sorting)
Prevents dangerous landfill dumping (mercury, lead) and potential health issues	Can be confusing for people – requires information campaign
Sense of community from sharing of resources (reuse essentially)	Can be “too hard”
Important educative component (ethical)	Collection facilities are not adequate currently, can be messy as a result
Employment, if properly organised	
Keeps the streets clean	
Saves wildlife	

Summary of Focus Group Discussions

Appendix C

What do you do or would you do with your old televisions/computers?

- Store them
- Look for recycling solutions on Google or elsewhere
- Give them away (when reusable)
- Trade them in when buying a new item
- Put them for hard rubbish collection
- Take them to the tip

What would be the characteristics of a good recycling scheme (whiteboard exercise)?

- Provide a path for the safe disposal of unwanted equipment
- Includes Governmental guidance
- Should focus on preventing pollution
- Should include a provision for reusing equipment in working order first
- Should include a provision for the reuse of recovered material
- Should include an education / information program vis-à-vis the dangers of waste
- Should be cost-effective
- Should be convenient
- Should foster innovation and research

Who should pay for a recycling scheme (whiteboard exercise)?

- Manufacturers, depending on how hard to recycle their products are, as this would foster innovation and good product design.
- Build on European experience of an “eco-participation” built into the product cost.
- User pays principle is good.
- It was recognised that whether Government pays or manufacturers pays, the cost would be ultimately passed on to the general public.

Feedback on questionnaire:

- The questionnaire made you think about what your values are and what is important to you.
- Underlying desire to recycle, so disappointed to have to worry about cost.
- Quantity of information provided is good, more would be too much. Questionnaire length is OK. May need to discuss the impact of introduction of digital television in 2012.

About the choice sets

- Decision making basically balancing the differential between recycling percentages and the additional cost to pay to achieve this.
- Some people reported having found some inconsistencies between the choice sets, demonstrating that they had difficulties accepting that they needed to consider choice sets independently.
- Convenience was part of the decision making, always relatively to the cost.
- Also balancing convenience and safety in the decision making process.
- More attributes would have made it very difficult to decide.

Appendix C Summary of Focus Group Discussions

About the level of the cost attributes

- People emphasised that they believed calculations about potential costs had been made by experts and that the exercise would be undermined if it was not the case.
- The levels of recycling proposed were found believable, although people initially doubted that 90% would be achievable.

Is there a bias towards recycling?

- Generally it was found that this was not the case.
- Some people however mentioned that they had to check themselves to avoid getting to enthusiastic and give what they thought was “the right answer” rather than how they would behave in “real life”.

About the payment scenario

- A refund scheme was brought up spontaneously as a way to encourage people to bring back their old equipment (and was thought to be something that should be implemented widely, provided it can be done at reasonable cost).

About the collection method

- The need for a frequent / infrequent collection was discussed: the dividing line is whether people live in apartments (space constrained) and whether they move frequently. It was suggested that a twice yearly collection would be adequate and that it could be complemented by a drop-off facility (even if it is not local).
- People were quite conscious about the trade-off between convenience and cost.

About the possibility of disassociating televisions and computers

- Does not seem to make sense for people. Seen as the same good, except for the convenience element, as computers become more compact while television sets become bigger.

Summary

- Level of information provided is right – the schematic is useful.
- People need to believe the proposed costs are robust/well-founded – this may require some mention in the explanatory notes.
- The reuse component was found to be missing from the questions. People feel strongly that this should be included as part of a recycling scheme (which may conflict with manufacturers’ objectives). This indicates the need for an additional framing question or explanation to address this concern.

Additional insights

- A lot of discussion was around the need to inform people – of the need of recycling and of the way of doing it.
- A side issue that was discussed was whether the product levy (probably a percentage of the good purchased) should be made explicit in the price of the good purchased or just hidden in the cost (as for mobile phones).
- Strong support for a national scheme was expressed. Differences between councils were found to be irritating and counterproductive.

C.6 Brisbane Focus Group

Held on 11/12/08 - 7:00pm – 9:00pm

Attendees:

- Tony, Robert, Melissa, Colin and Naomi
- 2 women and 3 men attended from 10 that were recruited. Poor attendance was attributed to a thunder storm
- Mixed age group and mixed income and education levels

Facilitators:

L.Pechey (1st half), J. Bennett (2nd half).

About recycling:

What is recycling?

- Taking responsibility for a product when you're finished with it.
- Being efficient with resources. Cheaper and less damaging than finding fresh sources of materials.
- Associated with waste. Extending the life of resources.
- Re-use a product in the present form or in a different form.
- Re-using, as well as breaking stuff down. Looking out for stuff that you can use again.

Is there enough recycling?

- Enough, but there could be more. Nearly everything can be recycled. Everyone needs to be aware.
- Australia is a rich country and tends to waste things. In India, everything is recycled. It's a question of the wealth of a nation. In Australia, recycling is focused on cardboard and glass.
- Recycle when t makes economic sense but there's no legislation to require companies to recycle. We need more.
- Matter of knowing what to do. People not doing enough. My neighbours don't use their recycling bins.
- It's up to the consumer to buy things that are recyclable. New high-powered batteries are not recyclable. Prius batteries last 4-5 years and then need to be thrown out. Being responsible – only produce things that can be recycled. Buy cheap stuff from China, which breaks, then is thrown away. Should buy better quality that lasts. Tyres now being used to make lots of things. It's a matter of finding out what can be recycled.

Benefits of Recycling

- Less landfill
- Save resources
- Environmental benefit – reducing the amount of new materials
- Simple life – don't have to work so hard to get 2nd-hand products
- Teaches respect for resources
- Ethically good
- Saves energy
- Aesthetic value – less rubbish/mess in community
- Increases design options – increases opportunities to innovate and create recyclable products
- New industries

Drawbacks of Recycling

- Cost of energy to recycle
- New products can be cheaper and more efficient to produce

Appendix C Summary of Focus Group Discussions

- Increased cost of recycled products
- Requires diligence about collecting and separating
- Can reduce efficiency in the system – creates distortions because of legislation to recycle.
- How many times can something be recycled – eventually it breaks down
- Recycling reduces new product innovation
- Car producers make products that are recyclable, but that limits the design process.
- Can be inconvenient e.g. cloth nappies vs. disposable nappies

How do you dispose of worn-out televisions and computers?

- In the wheelie bin or I take it to the dump
- Don't know what to do with it
- Heavy metals in the landfill
- Do companies do the recycling? Reading articles about European waste going to Asia and Africa and kids running around stripping them – I don't throw things out. I give them to others. If they're broken, I fix them.
- Wait for Griffith University to send a notice out – and I deliver it to them for recycling
- Computer – give to someone to fix it. Televisions take it to the dump
- Put it on the footpath for the council to collect
- Someone else come around to pick it up

Should there be a different way of disposing of televisions and computers?

- Definitely!
- Recycling system is getting better, but it could be improved
- Should be able to connect those with broken machine to others who can fix them. Could incorporate a training programme

If there was a recycling scheme, what should be its objective?

- Sorting, dismantling and reclaiming valuable materials
- Get the glass and metals out. If the machine is not broken, then it should be repaired
- Should be the manufacturers' responsibility. Need to have products that are designed to be recycled
- In Japan the responsibility for recycling rests with the manufacturer. There should be a label on the side of the product that tells consumers what to do with the product

Do recycling companies make money?

- Manufacturers should help recyclers to be profitable
- Must be profitable, otherwise they wouldn't be in business
- Councils do it and they're not in it for the money, but Visy makes money because there's not a big labour component in the overall recycling costs
- Can be, it depends on the item
- Can be, but requires everyone to do their bit

About the questionnaire:

Participants were asked to comment on any issues that were raised on each page of the questionnaire.

Pg 2

- 'Australia' makes more sense than community

Pg 3

- Consider adding an option e for 'other'
- 'management' is a corporate term not a household term

Summary of Focus Group Discussions

Appendix C

Pg 5

- Liked the definition

Pg 6

- Should include a 'none of the above' option
- C and D should be shortened

Pg 7

- I skipped over the information in brackets, because I assumed that bracket-ed material isn't important

Pg 8

- It seemed as though there was an agenda; that the situation is really bad
- It's hard to tell if it's biased
- Why do we need this information?
- It's out of place here. Should move to Pg 2

Pg 10

- 'higher' needs to be qualified because it's ambiguous
- Should include a statement '*At present*, the overall cost of recycling…'

Pg 11

- Is it true that televisions and computers go to landfill?

Pg 12

- Diagram is good if it's in colour
- Need to change the arrows so that it looks like printed circuit boards, cabinet and CRT go to mechanical shredding
- Need to add computers

Pg 13

- I questioned the safety of landfill sites.
- The information about landfill sites could be better worded
- '3.5 million' should be given more context. What is this as a %? What is this relative to a swimming pool?
- This information could create a bias against recycling

Pg 14

- Need to include both hard rubbish and kerb-side collection as the same thing

Pg 15

- Need another category for disposal when the retailer collects the old item when they deliver the new item.

Pg 16

- I had to estimate

Pg 17

- Should make sure that the final dot point about the product levy stands out. I didn't take notice of it because it was the last dot point on the page

Appendix C Summary of Focus Group Discussions

Pg 18

- I thought the 'Call out' option meant that I would have to leave it on the kerb-side
- I thought someone would come to the front door
- Information about the current collection method may bias – should remove the reference to 7%

Pg 19

- Remove brackets because I don't read the information in brackets

Pg 20-25

- They weren't easy, but I went for the middle range
- I wasn't sure how kerb-side would work. How long would the items sit outside waiting to be collected
- I had some problems understanding how the collection method and % recycled/recovered affects price

Summary:

- There appeared to be confusion about the relative definitions of recycling and reuse. Many found that recycling involves reuse and this was reinforced about the comments regarding the objectives of a recycling scheme, e.g. a recycling scheme should aim to repair items that are not working and then recycle anything that can't be fixed
- A good range of benefits and drawbacks of recycling were identified
- There was some discussion about the need to address both sides of the process, e.g. product design *and* product disposal.
- Most assumed that the 'call-up' collection method would involve moving the item to the kerb-side. One person thought that it would be collected from their front door
- Feedback on the questionnaire was positive. There appears to no major changes required

Chi-Square Test Results

Appendix D

Chi-Square Test Results

Appendix D

Table D-1 Chi-Square test results – Adelaide

	ABS		Survey		Chi-Square	P-value
	No.	Percentage	No.	Percentage		
Adelaide						
Sex						
Males	539,868	48.8%	154	50.5%	0.3413	0.5591
Females	565,972	51.2%	151	49.5%		
Age						
18-34	252773	29%	94	31%	0.3710	0.9462
35-44	159920	18%	55	18%		
45-54	156732	18%	54	18%		
55+	295198	34%	102	33%		
Household income						
Under $13,000	36,744	9%	14	5%	60.1565	<0.0001
$13,000-$25,999	58,023	13%	33	11%		
$26,000-$33,799	48,630	11%	19	6%		
$33,800-$41,599	30,987	7%	20	7%		
$41,600 - $51,999	31,972	7%	29	10%		
$52,000-$62,399	46,869	11%	23	8%		
$62,400-$72,799	24,204	6%	29	10%		
$72,800-$88,399	31,386	7%	30	10%		
$88,400-$103,999	24,116	6%	37	12%		
$104,000-$129,999	24,179	6%	26	9%		
$130,000-$155,999	16,960	4%	7	2%		
$156,000+	14,373	3%	10	3%		
Not answered	42,337	10%	28	9%		
Household income (high/low)						
Low	253,225	59%	138	45%	29.1888	<0.0001
High	135,218	31%	139	46%		
Not answered	42,337	10%	28	9%		
Household composition						
Single person household	121,274	28%	50	16%	66.7332	<0.0001
Shared household	15,768	4%	35	11%		
Couple without children	112,344	26%	87	29%		
Family	181,393	42%	133	44%		
Dwelling type						
House	331,336	77%	263	86%	21.5418	<0.0001
Townhouse	*52,049*	12%	11	4%		
Unit/apartment	*45,696*	11%	31	10%		

Appendix D Chi-Square Test Results

	ABS		Survey		Chi-Square	P-value
	No.	Percentage	No.	Percentage		
Education						
Diploma/Certificate	215,876	24%	101	33%	25.2508	<0.0001
Bachelor degree	101,721	11%	46	15%		
Postgraduate	33,905	4%	22	7%		
Total post school age	908,545		305			

Table D-2 Chi-Square test results – Brisbane

	ABS		Survey		Chi-Square	P-value
	No.	Percentage	No.	Percentage		
Brisbane						
Sex						
Males	866,431	49.1%	145	47.2%	0.4483	0.5031
Females	896,701	50.9%	162	52.8%		
Age						
18-34	444543	33%	128	42%	10.6335	0.0139
35-44	265825	20%	50	16%		
45-54	237787	18%	55	18%		
55+	381591	29%	74	24%		
Household income						
Under $13,000	36773	6%	12	4%	37.2638	0.0002
$13,000-$25,999	62398	10%	27	9%		
$26,000-$33,799	57,996	9%	25	8%		
$33,800-$41,599	39,296	6%	24	8%		
$41,600 - $51,999	44,340	7%	38	12%		
$52,000-$62,399	71,504	11%	19	6%		
$62,400-$72,799	38,808	6%	21	7%		
$72,800-$88,399	53,291	8%	29	9%		
$88,400-$103,999	43,046	7%	32	10%		
$104,000-$129,999	45,672	7%	30	10%		
$130,000-$155,999	36,228	6%	13	4%		
$156,000+	32,281	5%	9	3%		
Not answered	66,582	11%	28	9%		
Household income (high/low)						
Low	312,307	50%	145	47%	2.2264	0.3285
High	249,326	40%	134	44%		
Not answered	66,582	11%	28	9%		

Chi-Square Test Results

Appendix D

	ABS		Survey		Chi-Square	P-value
	No.	Percentage	No.	Percentage		
Household composition						
Single person household	**140,120**	22%	40	13%	78.8380	<0.0001
Shared household	**31,587**	5%	45	15%		
Couple without children	**164,330**	26%	103	34%		
Family	**292,179**	47%	119	39%		
Dwelling type						
House	502,673	81%	227	74%	9.2812	0.0097
Townhouse	*45,586*	7%	29	9%		
Unit/apartment	*74,295*	12%	51	17%		
Education						
Diploma/Certificate	333,618	24%	92	30%	26.5506	<0.0001
Bachelor degree	179,154	13%	54	18%		
Postgraduate	61,251	4%	28	9%		
Total post school age	1,404,386		307			

Table D-3 Chi-Square test results – Melbourne

	ABS		Survey		Chi-Square	P-value
	No.	Percentage	No.	Percentage		
Melbourne						
Sex						
Males	1,760,907	49.0%	297	49.5%	0.0565	0.8121
Females	1,831,683	51.0%	303	50.5%		
Age						
18-34	899725	32%	203	34%	1.9327	0.5865
35-44	555575	20%	107	18%		
45-54	485651	18%	105	18%		
55+	833149	30%	185	31%		
Household income						
Under $13,000	92965	7%	35	6%	52.5155	<0.0001
$13,000-$25,999	135208	11%	66	11%		
$26,000-$33,799	117,488	9%	38	6%		
$33,800-$41,599	79,763	6%	44	7%		
$41,600 - $51,999	90,542	7%	52	9%		
$52,000-$62,399	135,742	11%	39	7%		
$62,400-$72,799	70,127	5%	44	7%		
$72,800-$88,399	100,221	8%	66	11%		
$88,400-$103,999	82,305	6%	58	10%		

Appendix D Chi-Square Test Results

	ABS		Survey		Chi-Square	P-value
	No.	Percentage	No.	Percentage		
$104,000-$129,999	84,866	7%	49	8%		
$130,000-$155,999	78,302	6%	20	3%		
$156,000+	72,598	6%	30	5%		
Not answered	143,175	11%	59	10%		
Household income (high/low)						
Low	651,708	51%	274	46%	10.5746	0.0051
High	488,419	38%	267	45%		
Not answered	143,175	11%	59	10%		
Household composition						
Single person household	**305,138**	24%	95	16%	182.0458	<0.0001
Shared household	**57,248**	4%	91	15%		
Couple without children	**309,225**	24%	172	29%		
Family	**611,691**	48%	242	40%		
Dwelling type						
House	937,620	73%	460	77%	29.5111	<0.0001
Townhouse	*145,395*	11%	28	5%		
Unit/apartment	*193,577*	15%	112	19%		
Education						
Diploma/Certificate	635,473	22%	184	31%	69.3757	<0.0001
Bachelor degree	418,336	14%	109	18%		
Postgraduate	153,950	5%	68	11%		
Total post school age	2,915,401		600			

Table D-4 Chi-Square test results – Perth

	ABS		Survey		Chi-Square	P-value
	No.	Percentage	No.	Percentage		
Perth						
Sex						
Males	713,917	49.4%	147	48.2%	0.1777	0.6734
Females	731,160	50.6%	158	51.8%		
Age						
18-34	347686	32%	109	36%	3.1979	0.3621
35-44	218066	20%	51	17%		
45-54	204922	19%	55	18%		
55+	328725	30%	90	30%		

Chi-Square Test Results

Appendix D

	ABS		Survey		Chi-Square	P-value
	No.	Percentage	No.	Percentage		
Household income						
Under $13,000	35288	7%	7	2%	45.9486	<0.0001
$13,000-$25,999	54379	10%	37	12%		
$26,000-$33,799	49,067	9%	15	5%		
$33,800-$41,599	33,355	6%	28	9%		
$41,600 - $51,999	36,746	7%	25	8%		
$52,000-$62,399	55,348	10%	27	9%		
$62,400-$72,799	28,157	5%	29	10%		
$72,800-$88,399	42,241	8%	36	12%		
$88,400-$103,999	34,928	7%	28	9%		
$104,000-$129,999	34,836	7%	21	7%		
$130,000-$155,999	33,125	6%	13	4%		
$156,000+	28,271	5%	10	3%		
Not answered	62,794	12%	29	10%		
Household income (high/low)						
Low	264,183	50%	139	46%	6.3115	0.0426
High	201,558	38%	137	45%		
Not answered	62,794	12%	29	10%		
Household composition						
Single person household	**132,174**	25%	44	14%	44.1230	<0.0001
Shared household	**20,249**	4%	29	10%		
Couple without children	**138,115**	26%	99	32%		
Family	**237,996**	45%	133	44%		
Dwelling type						
House	418,165	80%	249	82%	23.3215	<0.0001
Townhouse	*62,252*	12%	14	5%		
Unit/apartment	*45,059*	9%	42	14%		
Education						
Diploma/Certificate	290,672	25%	105	34%	52.8092	<0.0001
Bachelor degree	145,909	13%	52	17%		
Postgraduate	45,588	4%	33	11%		
Total post school age	1,162,857		305			

Appendix D Chi-Square Test Results

Table D-5 Chi-Square test results - Sydney

	ABS		Survey		Chi-Square	P-value
	No.	Percentage	No.	Percentage		
Sydney						
Sex						
Males	2,028,730	49.3%	285	48.5%	0.1436	0.7047
Females	2,090,461	50.7%	303	51.5%		
Age						
18-34	1035857	33%	190	32%	0.7609	0.8588
35-44	629683	20%	112	19%		
45-54	556842	18%	104	18%		
55+	928161	29%	182	31%		
Household income						
Under $13,000	101293	7%	15	3%	114.8837	<0.0001
$13,000-$25,999	136683	10%	49	8%		
$26,000-$33,799	118,909	8%	42	7%		
$33,800-$41,599	79,480	6%	39	7%		
$41,600 - $51,999	89,382	6%	44	7%		
$52,000-$62,399	136,293	10%	46	8%		
$62,400-$72,799	70,652	5%	37	6%		
$72,800-$88,399	108,860	8%	60	10%		
$88,400-$103,999	93,483	7%	90	15%		
$104,000-$129,999	100,001	7%	51	9%		
$130,000-$155,999	110,426	8%	29	5%		
$156,000+	116,957	8%	34	6%		
Not answered	161,116	11%	52	9%		
Household income (high/low)						
Low	662,040	47%	235	40%	49.1749	<0.0001
High	600,379	42%	301	51%		
Not answered	161,116	11%	52	9%		
Household composition						
Single person household	**328,516**	23%	66	11%	187.3811	<0.0001
Shared household	**59,614**	4%	83	14%		
Couple without children	**335,500**	24%	177	30%		
Family	**699,906**	49%	262	45%		
Dwelling type						
House	905,635	64%	417	71%	21.1568	<0.0001
Townhouse	*168,433*	12%	36	6%		
Unit/apartment	*339,782*	24%	135	23%		

Chi-Square Test Results

Appendix D

	ABS		Survey		Chi-Square	P-value
	No.	Percentage	No.	Percentage		
Education						
Diploma/Certificate	760,768	23%	203	35%	94.5798	<0.0001
Bachelor degree	484,221	15%	118	20%		
Postgraduate	179,250	5%	71	12%		
Total post school age	3,314,160		588			

Protest Responses

Appendix E

Protest Responses Appendix E

Verbatim Responses to Question 21 – Why people were not willing to pay for a recycling scheme
$ mentioned are too dear for most ppl. it would fail ultimately.
Any items that I can recycle I give to charities that revamp and give to needy.
business should pay, stuff there profits
companies make money out of our recycled items, why should we pay for them.
Council rates are high enough as it is
Don't Re-use - Copy 1 exact quality product times by sun, maybe saint's know how
far more important matters to be dealt with before recycling
i dont think you should have to pay to get rid of your rubbish
I have always given away my old TV's and computers to more needy people. Re-use
i live in a unit
i object and i dont throw out goods..i give them away instead.
I pay a lots rates
I pay for normal collection - recycling should not cost as we are giving back ma
I pay for the transfer station and it gets sorted there into different piles
I PAY RATES FOR COUNCIL TO DO THIS
I sell off the existing computer to allay the cost of replacement
I Try to reuse & recycle products people leave on the Kerbside
I want someone to remove the old tv from inside my house as I cannot lift it
its covered in my council rates
no reason
None of you answers suit me as I dismantle each item down to it's component piec
other
our local tip has drop off point for computers & tvs
people who recycle should be rewarded not have to pay out for this service
Re-cycling is a bigger waste of energy and recourse than high temperature burning
recycling is an industry that makes money why shoul i increase their profits?
small fish compared to industry/govt
the companies sell the product should be responsible for this
the cost of new units is high enough already
The manufacturers should be responsible for recycling as they produce it
the recovered material is sold back to users, why should the consumer pay again
there should be a levy put on to the supplier for recycle costs before sale
tv/comp.are always left outside in the area that I live & gone the next day!
we pay already for recycle bin why should I pay again
we pay tax for that service
we resell long before it needs to be thrown out
will give to charity

Additional Analysis: sensitivity to income and education variables

Appendix F

Additional Analysis: sensitivity to income and education variables

Appendix F

F.1 Models split by income category

	ALL			LOW	< 41,600 $/year		MED	41,600 – 44,399		HIGH	> 88,400 $/year	
Variable	Parameter		Z-value	Parameter		Z-value	Parameter		Z-value	Parameter		Z-value
ASC (1=change)	-0.166		-0.222	1.129		0.895	1.606		1.132	-0.384		-0.269
COST	-0.059	***	-41.007	-0.046	***	-19.104	-0.066	***	-26.537	-0.070	***	-23.334
RECOV	0.032	***	15.265	0.013	***	3.188	0.029	***	7.509	0.044	***	10.762
DROPOFF	-0.135	*	-1.777	-0.172		-1.316	-0.140		-1.066	-0.241		-1.597
AGE	-0.015	**	-2.138	-0.007		-0.694	-0.034	***	-2.926	-0.030	**	-2.078
EDUC	0.192	***	3.959	0.086		1.130	0.154	*	1.874	0.169	**	2.044
INC ('000)	0.013	***	4.422	0.023		1.319	0.001		0.056	0.015	*	1.911
GEN (1=male)	-1.022	***	-4.489	-0.958	***	-2.876	-0.628	*	-1.760	-0.101		-0.254
UNIT (1=unit)	0.573	**	2.040	-0.707	*	-1.873	0.615		1.415	1.840	***	3.198
st dev on RECOV	0.053	***	27.579	0.062	***	17.129	0.062	***	18.478	0.060	***	16.218
st dev on DROPOF	2.245	***	30.929	2.144	***	15.772	2.269	***	18.231	2.526	***	16.702
Error Component	3.990	***	23.983	2.646	***	10.399	3.579	***	14.021	3.515	***	12.526
Log-L	-7925			-2551.47			-2943.57			-2397.82		
BIC	1.396			1.474			1.381			1.366		
adj-ρ2	0.369			0.342			0.381			0.391		
n	1906			588			721			597		
WTP_rec	0.547	***	(0.49-0.61)	0.283	***	(0.12-0.45)	0.435	***	(0.33-0.54)	0.635	***	(0.54-0.73)
WTP_drop	-2.274	*	(-4.73- -0.18)	-3.768		(-9.29-1.76)	-2.107		(-5.95- -1.73)	-3.446		(-7.57-0.68)

*** *Significant at the one per cent level*

When splitting the sample into three revenue category, the income variable is no longer significant (or only slightly significant for the highest category), indicating that the split is appropriate. There is significant overlap of the confidence intervals for the WTP between the low and medium income categories, but only marginal overlap between the medium and high income categories.

Appendix F Additional Analysis: sensitivity to income and education variables

F.2 Models split by education category

	ALL			LOW_EDU			HIGH_EDU		
Variable	Parameter		Z-value	Parameter		Z-value	Parameter		Z-value
ASC (1=change)	-0.674		-0.949	1.388		0.769	0.973		0.844
COST	-0.060	***	-41.036	-0.058	***	-26.013	-0.062	***	-32.215
RECOV	0.030	***	13.634	0.023	***	6.895	0.035	***	12.442
DROPOFF	-0.144	*	-1.833	-0.151		-1.136	-0.169	*	-1.684
AGE	-0.019	***	-2.780	-0.025	***	-2.023	-0.010		-1.172
EDUC	0.247	***	5.044	0.154		1.074	0.034		0.463
INC ('000)	0.010	***	3.486	0.004		0.790	0.018	***	5.184
GEN (1=male)	-0.707	***	-3.278	-0.985	***	-2.601	-0.539	*	-1.920
UNIT (1=unit)	0.329		1.241	-0.114		-0.251	1.101	***	3.190
st dev on RECOV	0.057	***	28.703	0.054	***	17.219	0.060	***	22.857
st dev on DROPOF	2.293	***	28.960	2.420	***	18.025	2.305	***	24.244
Error Component	3.584	***	23.333	3.883	***	14.386	3.445	***	17.363
Log-L	-7922.96			-3025.52			-4872.37		
BIC	1.4			1.42			1.38		
adj-ρ2	0.369			0.363			0.377		
n	1906			720 (37.8%)			1186 (62.2%)		
WTP_rec	0.504	***	(.44 - .57)	0.402	***	(.30 - .51)	0.573	***	(.49 - .65)
WTP_drop	-2.409	*	(-4.9 - .11)	-2.594		(-7.0 - 1.9)	-2.744	*	(-5.9 - .41)

*** *Significant at the one per cent level*

When splitting into 'low' education (year 12 or less) and 'high' education (more than year 12), the education variable is no longer significant (as indicated by the absence of stars in the table), indicating that there is no other impact of education beyond the broad split.

The WTP for recovery is lower for the 'low' education group with only marginal overlap between the confidence intervals on WTP. A Poe-test[14] shows that these WTPs are significantly different at the 5% level of significance.

The WTP for drop-off is not significantly different between sub-samples.

[14] See Poe, Giraud and Loomis (2005) for a discussion of this test and how it can be applied.