Generation and Diversion of White Goods from Residential Sources in Canada

January 2005

Prepared for

Canada

Government of Canada
Action Plan 2000 on Climate Change
Enhanced Recycling Program

By

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ELECTRO-FEDERATION CANADA

HILKENE INTERNATIONAL POLICY

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Acknowledgements

Enhanced Recycling, Government of Canada Action Plan 2000 on Climate Change, Minerals and Metals Program

The Government of Canada Action Plan 2000 on Climate Change Minerals and Metals Program is working towards reducing Canada's greenhouse gas (GHG) emissions from the minerals and metals sector. By matching funds with other partners, this program supports initiatives that enhance recycling practices and provide GHG emission reductions. The project proponents would like to recognize the Natural Resources Canada, Minerals and Metals Sector for providing direction and input to the development of this project.

The authors would also like to thank the following organizations for their assistance and support in the research and writing of this report:

Association of Home Appliance Manufacturers
Association of Municipal Recycling Coordinators
Association des Organismes Municipaux de Gestion des Matières Résiduelles
Camco Inc.
Electrolux Home Products North America
Environment Canada
Maytag Canada
Natural Resources Canada
Nova Scotia Department of Environment and Labour
Recycling Council of Alberta
Recycling Council of British Columbia
Resource Conservation Manitoba
Saskatchewan Waste Reduction Council
The Greater Toronto Apartment Association
W.C. Wood Company Limited
Whirlpool Canada

Executive Summary

Purpose of Study

The purpose of this study is to gain a better understanding of the systems in place to manage the recovery and recycling of white goods (major home appliances) in Canada and to assess the energy savings and greenhouse gas emissions reductions attributable to white goods recycling.

Generation and Composition

One of the first steps in characterizing an effective and efficient integrated waste diversion program for a product stream or material is to compile reliable baseline information as to current waste generation and diversion activities. For white goods, this type of information is generally not well tracked in Canada. This report is an attempt to establish an understanding of material flows and the current systems in place in Canada to manage end-of-life white goods.

It is estimated that in 2002 approximately 3.9 million white goods – refrigerators, freezers, ranges, dishwashers and clothes washers and dryers – were sold in Canada. At the same time, approximately 2.8 million end-of-life units entered the solid waste stream to be managed through recycling, reuse or disposal.

Based on typical product life spans of between 8 and 16 years (depending on product category), approximately 17 million units will become obsolete over the five year period between 2002 and 2007 resulting in the generation of about 209,000 tonnes of scrap material per year or 1.27 million tonnes of total scrap material.

The scrap is comprised of approximately 67 percent ferrous metals, 8 percent non-ferrous metals and 25 percent plastics and other materials. While the individual weights of large appliances vary considerably from one product category to another and between models within any given category, the typical weight per unit is about 74 kilograms.

White Goods Recovery

Applying conservative estimates, the recovery and recycling rate for major appliances in Canada is as high as 92 percent of all units entering the waste stream annually. At the high end, this places Canada among the most successful countries in the world in terms of overall white goods diversion.

With exceptions, the white goods that do end up in landfill sites are more likely to be generated in more remote locations where shipping and environmental costs may not justify their transportation to recycling centers.

According to a national survey of Canadian municipalities conducted as part of this study, it is estimated that in 2002 municipalities recovered between 26 and

38 percent of all obsolete white goods generated in 2002 (approximately 209,487 tonnes). This represents between 54,851 and 80,687 metric tonnes.

Similar surveys of both major and independent appliance retailers indicate that, upon delivery of a new appliance, many businesses will remove an old appliance from a customer's premises resulting in the recovery through take-back of an amount equivalent to approximately 15 percent of the number of new units being sold (at retail) in Canada. This is especially true in the Province of Quebec where old-unit take-away is a greater competitive consideration among major retailers.

Major retailers are attributed with taking back approximately 15 percent of all obsolete white goods or 31,422 tonnes.

Small- to medium-sized independent retailers reported that they take back a similar quantity of old appliances when delivering new units. Like free delivery, old product take-back is considered a competitive advantage for smaller businesses when competing with major appliance sellers. Small- to medium-sized independent retailers represent approximately 20 percent of the total retail market. Independent retailers diverted roughly 14 percent or 28,490 tonnes of white goods from the municipal waste stream in 2002.

Therefore the combined recovery and diversion of white goods from major and independent retailers is estimated to be 59,912 tonnes or 29 percent of the total white goods entering the waste stream annually.

Calculations of the combined municipal and retail efforts indicate an overall diversion of between 114,763 and 140,599 tonnes (between 55-67 percent).

The balance of white goods that are managed through other means such as curbside scavenging, donation or resale, apartment building recycling and disposal, is estimated to be between 68,888 and 94,724 tonnes or 33 to 45 percent of total generation.

Among these 'other' systems apartment and condominium buildings are thought to manage about 62,000 units weighing roughly 4,650 tonnes. Of this quantity, the bulk is sold to private companies. It is thought that less than 10 percent are landfilled. This means that about 4,185 tonnes are diverted from multi-unit buildings primarily through recycling.

'Unofficial' diversion by private sector entrepreneurs who scavenge white goods that are placed at the curbside for municipal recycling or disposal collection are responsible for a surprisingly high level of diversion. It is estimated that half of all units not recovered by municipal programs are managed in this manner, often with the blessing of the local municipality. Scavenging is thought to divert between 29,000 and 40,000 tonnes or as high as 19 percent of all available units.

Finally, there is the reuse sector consisting of sales by individual homeowners, second-hand appliance stores, charity resellers, and appliance repair businesses. It has been estimated that as many as 10 percent of the units recovered through retail and apartment building programs are reconditioned and resold. It is assumed that a similar percentage is recovered directly from householders who either sell or donate them to a reselling agency.

Resellers are estimated to divert between 6,470 and 9,054 tonnes of white goods annually. This equates to roughly 120,000 resale units per year. These resale units effectively defer the recycling of this material until the second-hand units reach the end of their useful lives. In most cases, these re-used or re-conditioned appliances will end up entering the recycling stream at the complete end-of-life cycle.

The estimated combined diversion of white goods through municipal, retail, multi-unit, scavenger and reseller programs is between 150,349 and 194,580 tonnes or between 74 and 92 percent of all available obsolete units. This means that between 8 and 26 percent of white goods are disposed of in landfill sites.

Using diversion assumptions at the high end of the estimated range, Canada's white goods diversion programs can be considered as effective as programs in the United States where annual white goods diversion is estimated to be about 89 percent. This also makes Canada's program among the most successful of all countries.

It is difficult to ascertain the quantity or total weight of appliances that are diverted from Canada to recovery facilities in the United States. However, it is known that since many of the urban and more populated areas of Canada are located close to the border with the United States that this cross-border transportation occurs. This is further enhanced by today's relatively high scrap steel prices and favorable currency exchange rates.

Systems Design

94 percent of Canadian municipalities surveyed have some sort white goods recovery program. Program design and financing mechanisms vary considerable among jurisdictions.

By far the most common type of service is the permanent depot facility. This is especially true of provinces west of Ontario. Curbside collection is also offered on either a weekly, bi-weekly, monthly or seasonal basis. This is more often the case in the provinces of Ontario, Quebec and Nova Scotia. Population within a community tends to determine the level of service provided.
The majority of municipalities charge the public a fee to help offset ODS management and other handling costs.

Roughly 64 percent of municipalities surveyed reported that they track quantities of white goods recovered. The quality of data varies considerably from one program to another. There are no standard measurement protocols for tracking white goods diversion.

Municipal residential programs focus primarily on single unit dwellings. Condominiums contribute virtually no end-of-life appliances to the municipal waste stream and private apartments and public housing are estimated to contribute less than 10 percent of the appliances they dispose of.

Municipal Programs

Determining the relative effectiveness of curbside collection is difficult because a percentage of municipalities that offer curbside collection also provide depot service. The overwhelming majority of municipalities do not track their curbside and depot programs separately.

A significant number of municipalities do not have a clear picture of the revenues and costs associated with their white goods programs. This is due to a combination of factors including:

- ✧ Poor understanding of quantities managed;
- ✧ Costs are hidden in other administrative, operational and promotional budgets;
- ✧ Range of program types (E.g. curbside, depot, special days);
- ✧ Multiple white goods contracts with different contractors responsible for different service areas within a jurisdiction;
- ✧ No rationale for detailed tracking;
- ✧ Revenues hidden in total scrap metal revenues; and,
- ✧ Lack of a generally accepted waste management accounting practice.

Both revenues and costs vary widely, even among communities of similar populations and geographic proximity.

Of the 22 programs that reported both revenue and expenses, 11 were determined to operate at a net cost while nine showed a revenue surplus.

Of communities that reported both costs and revenues, the national weighted net average program cost was $37.68 per tonne. The net per capita cost of these programs, representing about 18 percent of the national population, is 7.82 cents. This translates into about 20 cents per household.

Applied nationally to all communities and households, the net annual cost of municipal white goods management would be approximately $2.3 million.

Because of the potential for both costs and revenues to be hidden in other municipal waste budgets, financial data presented in this report is not conclusive and should be considered representative only.

Retail Programs

The majority of Canadian retailers have policies in place to remove an old appliance from a customer's premises when a new one is delivered. Most major retailers charge removal fees, sometimes incorporated within their delivery charge. These fees range from $10 to $100 per unit.

Policies within a company vary from region to region across Canada depending on, independent franchisee decisions, contracts with third party delivery companies, and access to used appliance purchasers or scrap metal companies. Competitive market conditions also affect regional take-back policies.

As with municipalities, retailers, whether large or small, were unable to provide accurate records of the number of obsolete units recovered. Instead, recovery was expressed as an estimate of the percentage of new units sold.

The retail sector is collectively responsible for diverting about 29 percent of all white goods entering the waste stream.

Packaging

The typical weight of all new appliance packaging sold in Canada is about 6.32 kilograms of which 72 percent is corrugated cardboard. The total weight of large appliance packaging (in 2002) was roughly 24, 587 tonnes. The composition of packaging associated with new appliances is changing. Shrink-wrap is increasing use to replace corrugated cardboard.

A small percentage of white goods packaging actually enters the municipal waste stream. The overwhelming majority of retailers either take back packaging from a customer's premises or defrock appliances at the warehouse/distribution centre prior to shipping.

It is estimated that 84 percent of appliance packaging is managed by retail programs and the builders market. Municipalities manage about 16 percent, or roughly 3,394 tonnes.

Greenhouse Gas Emission Reductions

Considerable work has been conducted in Canada and internationally to develop conversion factors for estimating the energy savings and GHG reductions associated with the reduction, reuse, recycling, composting and disposal of a variety of materials commonly found in the waste stream.

Using conversion factors available at the time of writing this report it is estimated that recycling of steel and aluminum from recovered white goods resulted in emissions reduction of between 131,440-162,665 tonnes of carbon dioxide equivalent in 2002.

Environmental Considerations

Recovery and recycling of end-of-life white goods recovery programs can also have additional environmental benefits including the reduction of both ozone depleting substances and mercury releases into the environment.

Ozone Depleting Substances

The Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal Protocol) is a multi-lateral agreement that has established a schedule to reduce the production and importation of ozone-depleting substances. Signatory countries, such as Canada, must develop legislative and regulatory mechanisms that control the import, manufacture, use, sale and export of ODSs. They require gradual reductions of the production and import of these substances.

Under the Montreal Protocol many countries, including Canada, have measures in place for the recovery CFCs from the cooling systems in refrigeration units. At present, only the European Union has regulation that applies to insulating foam.

All 10 provinces and 3 territories have established regulations addressing ODS pollution prevention and the reduction of ODS emissions and the federal government has developed similar regulations for Federal facilities.

It is estimated that municipal and retail recovery programs managed between 66,413 and 82,111 kilograms of CFCs from refrigerator and freezing cooling systems in 2002.

The total amount of ODS from foam insulation in fridges and freezers entering the waste stream in 2002 is estimated to be between 209,300 and 402,500 kilograms.

However, as previously mentioned, CFCs have not been used in refrigerator-freezers in North America since 1994. Given a typical expected life of between 8 and 16 years for a refrigerator-freezer, it should be noted that the release of CFCs from refrigerators and freezers is projected to start decreasing as of 2002 to the point where there will be virtually no emissions by 2010.

Mercury

Because of the unique properties of mercury (it is a conductive metal that can be either a liquid or vapour over normal temperature ranges), it has been used for decades in appliances in one of three ways:

1) As a component of switches found in some chest freezers and a few models of washing machines,
2) As part of the safety gas shut off system in gas-fueled kitchen ranges with pilot lights, and
3) In the fluorescent lights that backlight the control panels on some stoves and washing machines.

There currently is no legislative or regulatory requirement in Canada or the US to recovery mercury from white goods prior to disposal. At present, at least eight Canadian municipalities have mercury recovery programs in place and another seven have indicated they are planning to implement mercury recovery programs.

In recent years, the numbers of appliances produced with mercury components has been decreasing. In several of the applications listed above, production of appliances containing mercury components has ceased meaning these appliances will no longer be present in the recycling stream. For example: nine percent of appliances involved in a 2001 pilot were found to contain mercury devices.

Information on mercury recovery is available from manufacturers to municipal recovery program operators, private dismantlers, and waste recovery facilities.

Canada in the International Context

Concern about the disposal of white goods is an issue that is international in nature. Many countries either have, or are developing, mechanisms to increase recovery and recycling rates for white goods.

Canada's recovery rate is comparable to those of the other countries examined. According to the estimates made annually by the Steel Recycling Institute in the United States, the recycling rate for major appliances there in 2003 was 89%. This rate has increased steadily since it was first measured in the 1990's. With the exception of Japan, where the historic recovery rate is 30 percent, most countries examined calculate current recovery rates between 50 and 90 percent. Like the United States, Canada's recovery system is largely economically driven and the appliances are pulled through the system by the price of metals and other materials that have value at end of life.

Japan and US states, like Canada, have historically addressed white goods as distinct from other electrical and electronic equipment. However, this is changing. Driven by efforts of European countries, the UK and Australia increasingly address white goods recovery in the broader context of waste electrical and electronic equipment.

For the most part, Canada has also managed to achieve its recovery rates without the legislative and regulatory requirements imposed by other countries. British Columbia is the only province in Canada to ban the landfilling of white goods.

Japan, Europe and 18 US states have enacted bans on landfilling of white goods. A further 18 US states require white goods to be separated from the mixed waste stream at the landfill for recycling.

Japan, Europe and the UK have also legislated extended producer responsibility (EPR). In almost all cases, manufacturers and retailers have opted to develop collective mechanisms for take-back and recycling of end-of life white goods. Municipalities are generally required to provide household collection services for end-of life appliances.

A number of jurisdictions (including Japan, four European countries and three US states) require consumers to pay a visible fee or tax for the disposal of white goods. In Canada, no such fees exist, with the exception of charges for the management of Ozone Depleting Substances.

In many respects, Canada's efforts most resemble Australia, where four key industry associations in cooperation with governments are driving voluntary efforts.

Generation and Diversion of Obsolete White Goods From Residential Sources in Canada

1. Introduction

In response to environmental and economic issues associated with solid waste disposal, governments around the world have introduced a range of product-specific "stewardship" measures to encourage higher levels of recycling, design for the environment (DFE) and cost recovery.

By reducing the volume of materials disposed of and by increasing the amount recycled, fewer natural resources are needed for the production of new products. This results in energy savings and a reduction in emissions of greenhouse gases and other pollutants.

Stewardship measures include everything from product take-back programs, to mandated recycling targets, landfill bans, special taxes, advance disposal fees, and phase-out of toxic components.

Among the categories of consumer goods commonly caught by these programs are automobiles, electronics and communications equipment, beverage containers and other packaging, tires, paints, motor oil, batteries, and other products that may end up as "hazardous" or "special" wastes, and major appliances, commonly referred to as white goods.

According to Environment Canada[1] there are at least 31 regulatory stewardship and 12 non-regulatory (voluntary) initiatives currently in place across Canada with 4 more currently under development.

Unlike European countries where stewardship programs tend to be national in scope, the majority of regulatory programs in Canada have been implemented at a provincial level. This has resulted in a patchwork of regulations across the country resulting in duplication of efforts for both governments and regulated businesses along with higher than necessary compliance costs. As a result, many organizations are calling for greater standardization and harmonization of programs across the country. By contrast, industry-led, non-regulatory approaches tend to be national in scope.

The appliance sector has been affected by federal and provincial regulations governing end-of-life management of ozone-depleting substances commonly used in refrigeration systems and polyurethane foam insulation. Appliance packaging not recovered by the private sector is also regulated in the Province of

[1] Environment Canada, Extended Producer Responsibility & Stewardship, An Inventory of Waste Diversion Programs in Canada, http://www.ec.gc.ca/epr/inventory/en/program.cfm

Ontario. However, to date, large appliances themselves have not been subject to provincial stewardship regulations.

This will likely change within the next few years if the market for steel changes and provincial governments move beyond the waste streams currently on their stewardship agendas and follow the lead of European countries, Japan and at least 36 US states where white goods are regulated to varying degrees.

According to the Canadian Appliance Manufacturers Association (CAMA), more than 3.8 million large household appliances were sold in the Canadian retail and builder (commercial/institutional) markets in 2002. This number represents the combined sales of refrigerators, electric and gas ranges, automatic washers, electric and gas dryers, dishwashers, and freezers. Microwave ovens, electric/gas cook tops, room air conditioners, and food waste disposers account for over one million additional units annually.

CAMA has estimated that the sale of 'core' products (refrigerators, ranges, washers, dryers and dishwashers) is growing by a little more than one percent per year, while the sale of 'non-core' products, such as room air conditioners and microwave ovens is increasing by about five percent.

There are significant differences between core and non-core products in terms of their manufacturing, distribution and waste management channels. Often the manufacturers are different and generation/sales data is tracked independently. Non-core products are often 'cash and carry' items meaning that retailers are not involved in home-delivery and services such as the removal and/or take-back of packaging or old end-of-life units. Finally, municipal waste management systems are less inclined to recover certain non-core products for recycling. For these reasons this study is concerned only with core products.

As new appliances enter the consumer market many will replace old or end-of-life items. The recycling rate for end-of-life appliances (ELAs) in Canada is considered relatively high due to well-established recycling and reuse infrastructures in both the public and private sectors. However, it has been difficult to estimate exact recovery rates because there are no reliable national tracking mechanisms or standard measurement protocols currently in use. In fact, very few municipalities or private companies have a clear picture of overall white goods material flows with the exception of refrigerators and freezers which often have paperwork associated with the mandated recovery of Materials Requiring Special Handling (MRSH) from their cooling systems.

There are many different approaches employed by both the public and private sectors to recover end-of-life white goods. These vary by region, size of community, location and size of appliance retailers, and the extent to which local recycling markets exist for recovered scrap materials.

The purpose of this study is to map recovery, reuse, recycling and disposal practices across Canada, both for end-of-life white goods and the packaging generated with the sale of new appliances. The findings will be used to estimate material flows and associated environmental benefits such as reduced greenhouse gas emissions and the diversion of pollutants including ozone depleting substances and mercury.

Specific goals include:

- ✧ Reviewing white goods recovery initiatives in other jurisdictions;
- ✧ Identifying the current and historical generation of specific types of white goods;
- ✧ Determining the material composition of various white goods entering the waste stream;
- ✧ Creating baseline estimates of white goods recovery and recycling activity across Canada;
- ✧ Quantifying estimated tonnages of specific materials recovered from various product streams;
- ✧ Estimating greenhouse gas emission reductions that result from the substitution of recycled white goods materials for virgin materials in metal smelting/refining operations;
- ✧ Identifying recovery opportunities and barriers (i.e., collection, handling challenges, municipal roles and responsibilities, distance to markets, etc.) to white goods recovery and recycling initiatives;
- ✧ Estimating the generation and diversion of consumer packaging associated with annual white goods sales;
- ✧ Identifying other environmental benefits that may accrue through recovery and recycling initiatives (e.g., packaging and mercury diversion); and,
- ✧ Providing recommendations for improved tracking of white goods recovery and enhanced performance of the white goods recovery infrastructure in Canada.

2. Definitions

"White Goods" refer to large household appliances, so named because they are generally white in colour. For the purpose of this report white goods include the following products:

- ✧ Refrigerators
- ✧ Freezers
- ✧ Dishwashers
- ✧ Ranges
- ✧ Clothes washers
- ✧ Clothes dryers

Other definitions may also include hot water heaters, air conditioners, in-sink food disposal units, and microwave ovens. However, as referenced in the introduction, this study focuses solely on the six product categories listed above. Additional study is recommended to characterize non-core white goods generation and recovery.

3. Methodology

This report attempts to:

- ✧ Quantify current and future waste/material flows associated with white goods generation, reuse, recycling and disposal in standard units of measurement;
- ✧ Evaluate effectiveness in terms of percentage diversion and participation rates; and
- ✧ Identify, where possible, costs and revenues associated with the operation of municipal recovery/diversion programs on a per tonne basis.

An initial literature review and Internet scan was conducted to identify international white goods recovery and diversion programs. The scan was also intended to identify existing tracking/measurement methodologies.

Seven national surveys were conducted in writing and by telephone involving the following sectors:

- ✧ Appliance manufacturers
- ✧ Canadian municipalities
- ✧ Major appliance retailers
- ✧ Small and medium independent appliance retailers
- ✧ Apartment building owners/managers
- ✧ Second-hand appliance resellers
- ✧ Scrap metal companies

In many cases the surveys were followed up with in-depth telephone interviews. Descriptions of the surveys follow with copies of questions included in Appendices A, B, D, E and G.

To address the issue of varied data tracking and reporting formats, a set of assumptions was developed to assist in the normalization and standardization of data sets. Performance assumptions were also made regarding municipal and private sector programs that did not participate in the surveys. Assumptions are stated throughout the report.

Survey data was analyzed to estimate material generation, composition, recovery flows and program costs according to geography, population, and type of program. Variable factors affecting recovery were identified and recommendations developed.

Qualitative information about environmentally sound management of ozone depleting substances from obsolete white goods was identified through a comprehensive review of Canadian federal and provincial laws. Literature

reviews on recovery of ozone depleting substances from polyurethane insulating foam and on mercury use and recovery were also conducted.

Summary recommendations for optimizing white goods diversion addressing data gaps are presented.

3.1 Appliance Manufacturers Survey

Canadian appliance manufacturers were surveyed first to obtain information in the following areas:

- ✧ Equipment weight and material composition by product category
- ✧ Estimated lifespan of appliances
- ✧ Amount and composition of packaging by product category

Companies surveyed include:

- ✧ Camco Inc.
- ✧ Electrolux Home Products
- ✧ LG Electronics Canada
- ✧ Maytag Appliances
- ✧ Miele Ltd
- ✧ Samsung Electronics Canada Inc.
- ✧ Whirlpool Canada
- ✧ WC Wood Company Ltd

Follow-up interviews with companies and the major associations representing manufacturers in Canada and the United States were also conducted.

3.2 Municipal Survey

Municipalities across Canada were sent copies of the municipal survey by email and in some cases by fax. Municipalities in the three Northern Territories were not included in the broadcast.

Contact lists for waste management officials were provided by the Recycling Councils of British Columbia (RCBC) and Alberta (RCA), the Saskatchewan Waste Reduction Council (SWRC), Resource Conservation Manitoba (RCM), the Association of Municipal Recycling Coordinators (AMRC), l'Association des organisms municipaux de gestion des matières résiduelles (AOMGMR), and various provincial government officials in the Atlantic Provinces. These lists were supplemented with a municipal contact list from the Federation of Canadian Municipalities' (FCM) publication, *A National Consultation on the Management of Discarded Electronics.* A comprehensive list was not available from the Federation of Canadian Municipalities.

Questions in the survey were designed to determine:

- ✧ Types of white goods collection programs;
- ✧ Levels of service;
- ✧ Quantities managed;
- ✧ End markets; and
- ✧ Costs and revenues.

74 municipalities representing 48 percent of the population of Canada responded to the survey.

3.3 Retail Surveys

Large and small appliance retailers across the country were contacted, in writing and/or by telephone to determine:

- ✧ Appliance sales volumes;
- ✧ Market presence in various geographic market areas;
- ✧ Delivery and take-back policies for appliances;
- ✧ Service fees charged, revenues received;
- ✧ End markets (recycling or resale) for take-back items; and,
- ✧ Packaging management policies.

Major Retailers representing approximately 65 percent of the retail appliance market in Canada were contacted. These include:

- ✧ Sears Canada Inc
- ✧ The Bay/Zellers (HBC)
- ✧ Wal-Mart
- ✧ Corbeil Electromenagers
- ✧ Tanguay/Brault Martineau (BMTC Group)
- ✧ The Brick Warehouse Corporation
- ✧ Leons Furniture Limited
- ✧ Future Shop/Best Buy
- ✧ Home Depot Canada
- ✧ Price Club/Costco

In addition, the Retail council of Canada was invited to support the research and communicate details to its members through its Environment Committee.

Due to industry-wide sensitivity about the potential release of proprietary sales information, it was necessary for the researchers to provide major retailers with a Letter of Non-Disclosure regarding their survey responses. For this reason, the breakdown of information from large retailers is presented in a generic format with references only to Company A, Company B, etc. Furthermore, due to the dominant position of one large retailer in the market it was necessary to disguise

sensitive information by aggregating data for a number of companies (Ie. Results for companies A, B & C combined).

Only one major retailer declined to participate in the study, while another failed to respond to repeated requests. Information for a third was gathered as part of the Independent Retailer survey.

Some large retailers provide detailed information about their product and packaging take-back policies on their web sites so it was possible to make informed deductions about overall performance without their active participation in the survey.

32 small to medium-sized independent retailers were also contacted by telephone survey to determine their appliance and packaging management policies and practices. Of these, four were unavailable and one declined to participate. It is estimated that independent retailers represent approximately 20 percent of the appliance market. Independents were not asked the same sensitive sales information questions and so are identified by name in the report

AMG Appliances, ON
Shuh Appliances, ON
Smith Vernon Furniture & Appliances, ON
Domaine, ON
Allen's Furniture Warehouse, ON
Blacks FW Ltd., ON
Shaw's Furniture & Appliances, ON
Metro Karges Appliances, ON
TA Appliance Warehouse, ON
Tepperman's Furniture Appliance, ON
Colonial Furniture, ON
*Corbeil Appliances,QC, ON
Abrams Leo P & Son Inc, ON
Bad Boy, ON
Bains Appliance Parts and Service, MB
Dufresne Furniture & Appliances, MB
Kern-Hill Furniture Co-op Ltd., MB
Atlas Appliances, AB
Bestway Television and Appliances, AB
Trail Appliances, AB, BC
Best Appliance Centre, AB
Bi-Rite Furniture Warehouse, BC
City Furniture (Pg) Ltd, BC
Northern Hardware and Furniture Co, BC
R K Furniture Gallery, BC
Ben's Direct Maytag Home Appliance Center, BC
Westcoast Appliance, BC
Stockli Maytag Home Appliance Centre, BC

**Due to the number of its locations (25), and estimated market share, results for this retailer were included with major retailers.*

3.4 Apartment Building Owners and Manager Survey

Major real estate and property management companies that own or manage multi-unit buildings in Canada were surveyed by telephone to determine:

- ✧ Management policies for obsolete white goods; and,
- ✧ Quantities and fates of obsolete white goods.

Companies contacted include:

- ✧ Olympia & York Properties Corporation

- ✧ Minto Developments Inc.
- ✧ Greenwin Property Management Inc.
- ✧ Homestead Land Holdings Limited
- ✧ Boardwalk Equities
- ✧ RealStar Properties Limited
- ✧ Simerra Property Management Inc.
- ✧ Brookfield Properties Corporation
- ✧ ResREIT (Residential Equities Real Estate Investment Trust)
- ✧ Greater Toronto Apartment Association
- ✧ Toronto Community Housing Association
- ✧ Ontario Non-Profit Housing Association

All but one of the companies listed above responded to requests for a telephone interview.

3.5 Appliance Resellers Survey

A scan of yellow pages advertisements from across Canada was undertaken to create a database of 227 second-hand appliance resellers (see Appendix F). This list is not considered to be comprehensive. There is no longer an industry association representing these businesses and North American Industry Codes were not useful in this regard.

Resellers were asked about:

- ✧ Sources and quantities of used appliances received;
- ✧ Relative proportions that are resold versus recycled;
- ✧ Costs and revenues associated with acquisition;
- ✧ Degree of used parts recovery for repair programs; and,
- ✧ State of the second-hand appliance industry.

3.6 Scrap Metal Industry Survey

126 scrap metal companies from British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, New Brunswick and Newfoundland were surveyed as part of the study. The companies were drawn from a database created as part of a national scan of metal and mineral recycling activities conducted for the Enhanced Recycling Program of *Action Plan 2000 on Climate Change* (Natural Resourves Canada) in 2003. The companies, including brokers, processors, and end users, had identified themselves as handlers of white goods.

Each company received the survey by fax or e-mail accompanied by a letter of introduction from CAMA that highlighted how data would be used and the confidentiality of company specific information.

The survey posed 13 questions focusing on the quantities of white goods recovered, the origin of the white goods, market factors influencing the quantity of white goods recovered and their ultimate fate.

Following two rounds of follow-up telephone calls and resending surveys to approximately 50 companies, only 16 completed surveys were returned. It should be noted that all of the 50 some companies to which surveys were resent indicated a willingness to complete and return surveys, but did not.

Reasons given for not participating in the survey include:

- ✧ Company has never, or no longer accepts white goods;
- ✧ Confidentiality concerns;
- ✧ A lack of staffing resources; and/or,
- ✧ Issues with government and/or manufacturers.

4. International Experience

As a preliminary step to research on Canadian programs, a literature review of international experience was undertaken to determine recovery rates for white goods in other countries as well as to gain insights into different recovery systems and methods for measuring white goods recovery. The literature review examined publications for Japan, European countries, the United States and Australia. The findings of the research are provided below.

4.1 Japan

In Japan, the disposal of electrical products, including white goods, falls under the jurisdiction of the national government. Prior to 1998, electrical products discarded by Japanese households were almost all disposed of in landfills. The Specific Household Electrical Appliance Recycling Law was enacted in 1998 in an effort to reduce the volume of such landfill disposal. Under this law, which went into effect in 2001, all owners of discarded refrigerators, televisions, air conditioners and washing machines pay up to €7,600 (~ $92 CAD) to have their used white goods taken away and recycled. Retailers are obligated to collect and transport the discarded appliances (consumers must pay the costs involved), and the manufacturer is obligated to recycle the materials.[2]

The Association of Electric Home Appliance Manufacturers of Japan estimates that 30 percent of used white goods were actually collected and recycled, with the rest ending up as landfill, prior to 2001. It is hoped that through the EAR recycling rates will improve to 50 percent for refrigerators and washing machines.

4.2 Europe

European countries, like Japan, deal with the disposal of electrical and electronic products at the national level. A number of European countries including Austria, Belgium, Denmark, Italy, Norway Portugal, Sweden, Switzerland, and The Netherlands have had some kind of Waste Electrical and Electronic Equipment (WEEE) legislation or negotiated agreements in place for a number of years. The white goods covered under these legislative or negotiated arrangements have typically differed from country to country. For example, Austrian legislation has only addressed fridges and freezers whereas The Netherlands WEEE legislation covers all white goods.

Under these legislative or negotiated agreements, municipalities are responsible for household collection, while producers are required to establish a collection system for the treatment, recycling and disposal of end-of-life products.

[2] Japan Access, "ENVIRONMENTAL ISSUES, Protecting the global environment." http://www.sg.emb-japan.go.jp/JapanAccess/environ.html)

Manufacturers, importers and retailers generally have developed collective systems to manage the take-back system through a series of contracts with waste transport companies and recyclers.

Usually, when a household buys a new product, the end-of-life product can be given back to the retailer/supplier irrespective of brand. Alternatively, the last user may return the end-of-life product to the local authority collection service. In Austria, Italy, Norway and Switzerland, a visible recycling fee is included in the cost of a new appliance, whereas, in the other countries, no visible fee is collected and end-of-life products can be returned free of charge.

In Europe, targets and recycling rates have differed from country to country. In Austria, for example, there is no collection target, but the collection rate for refrigerators/freezers is about 60 percent of sales of new products. In Belgium, a target of 90 percent has been established for large household appliances. In Denmark, the objective is to recycle 75 percent of all returned end-of-life equipment after 2007. 20 kilograms per inhabitant per year are currently being collected. In Italy, where a negotiated agreement was reached, there are re-use/recovery targets of 80 percent of weight for washing machines, 68 percent of weight for fridges and freezers and 65 percent of weight for dishwashers. In Norway, targets of 80 percent take-back and recycling apply as of July 2004. And in Portugal, 75 percent by weight of home appliance equipment has to be recyclable or re-usable.[3]

There is no mention of recycling goals in the language of the Netherlands's WEEE decree, but the explanatory memorandum states that recycling targets must be established. In 1996, the national government, local authorities, and manufacturers/importers conducted a pilot program to establish a basis for the approach set out in this law. Recycling goals were defined on the basis of the pilot's outcome. The recycling rate is measured as: weight percent of material not going to landfill or incineration/weight of material processed.

TABLE 4.1 European Recycling Targets Achieved

Product type	Target recycling rate	Recycling rate achieved
TVs	69%	78%
Large white goods	73%	74%
Cooling and freezing units	75%	86%
Other/small appliances	53%	64%

[3] Initiatives undertaken by EU Member States and Norway and Switzerland to deal with take-back and proper treatment of waste electrical and electronic equipment (WEEE), http://www.ceced.org/sites/ceced.org/community/files/144/phpM7ei7h/National_take-back_initiatives_(update_Feb_2002)_(website+HomeTech).doc

In the United Kingdom, local waste collection authorities are obliged to provide a collection service for bulky items, although they can charge a collection fee. Alternatively, householders can take appliances to a local civic amenity site for disposal free-of-charge. The local waste collection authority ensures that old appliances are disposed of safely.[4]

In 2001, it was estimated that more than 900,000 tonnes of used electrical and electronic goods were discarded. This figure includes up to 350,000 tonnes of large domestic appliances such as washing machines, fridges and cookers - over 8 million pieces of equipment in total. Studies have shown that a considerable proportion (greater than 75 percent) of these larger discarded appliances are already recycled profitably.[5]

At present, all European Economic Community (EEC) countries are establishing WEEE recovery systems consistent with of the European Economic Community's recent Directive on Waste Electrical and Electronic Equipment (WEEE) of January 27, 2003. The objective of the Directive is to prevent the generation of electrical and electronic waste and to promote reuse, recycling and other forms of recovery in order to reduce the quantity of such waste, while also improving the environmental performance of economic operators involved in its treatment.

The WEEE Directive applies to the following categories of electrical and electronic equipment:

- ✧ Large and small household appliances;
- ✧ IT and telecommunications equipment;
- ✧ Consumer equipment;
- ✧ Lighting equipment;
- ✧ Electrical and electronic tools (with the exception of large-scale stationary industrial tools);
- ✧ Toys, leisure and sports equipment;
- ✧ Medical devices (with the exception of implanted and infected products);
- ✧ Monitoring and control instruments; and,
- ✧ Automatic dispensers.

Under the WEEE Directive, member States must minimize the disposal of waste electrical and electronic equipment (WEEE) as unsorted municipal waste and must set up separate collection systems. In the case of electrical and electronic waste, Member States have to ensure that, from 13 August 2005: final holders and distributors can return WEEE waste free of charge; the same type of equipment can be returned to new product distributors free of charge on a one-to-one basis; producers are allowed to set up and operate individual or collective

[4] UK DEFRA, Waste and Recycling: Disposal of Waste Refrigeration Equipment, http://www.defra.gov.uk/environment/waste/topics/fridges/householders.htm
[5] UK Department of Trade and Industry, UnWanted White Goods: A Guide to ReUse, http://www.dti.gov.uk/support/whitegoods.pdf

take-back systems; the return of contaminated waste presenting a risk to the health and safety of personnel may be refused.

Producers must also provide for the collection of waste, which is not from private households. Member States must ensure that all waste electrical and electronic equipment is transported to authorized treatment facilities.

By 31 December 2006 at the latest, a rate of separate collection of at least 4 kg on average per inhabitant per year of waste electrical and electronic equipment from private households must be achieved. A new target rate, to be set at a later date, is to be achieved by 31 December 2008.[6]

4.3 United States

In the United States, the end-of-life management of white goods falls under state jurisdiction. Current options for major appliance disposal vary between states. As of 2001, 19 states had bans on the disposal of white goods at landfills, while another 16 states require that landfills separate white goods from the solid waste stream and recycle them. In addition, another 3 states allow landfills to decide independently if appliances can be admitted. A break down of state white goods disposal laws is provided in the following table.

TABLE 4.2 U.S. White Goods Disposal Laws[7]

STATE	DISPOSAL BAN	ADVANCE DISPOSAL FEE*	OTHER
Alaska			Fee up to Landfill.**
Arkansas	YES		
Arizona			Landfills must separate white goods for recycling.***
California	YES		Prohibits crushing appliance for transporting to shredder; hazardous waste must be removed prior to recycling.***
Colorado			Landfills must separate white goods for recycling.***
Connecticut			Landfills must separate white goods for recycling.***
Delaware			Landfills must separate white goods for recycling.***
Florida	YES		
Georgia			Landfills must separate white goods for recycling.***
Hawaii	YES		
Illinois	YES		
Iowa			Landfills must separate white goods for recycling.***
Kansas			Landfills must separate white goods for recycling.*** Localities can develop disposal plan.
Louisiana	YES		Landfills must separate white goods for recycling.***
Maine	YES		

[6] EUROPA, Waste Electrical and Electronic Equipment, http://europa.eu.int/scadplus/leg/en/lvb/l21210.htm

[7] Appliance Recycling Information Center, http://www.aham.org/aric/3aric.pdf

STATE	DISPOSAL BAN	ADVANCE DISPOSAL FEE*	OTHER
Maryland			Landfills must separate white goods for recycling.***
Massachusetts	YES		
Michigan			Landfills must separate white goods for recycling.***
Minnesota	YES		
Mississippi			Localities can develop disposal plan.
Missouri	YES		
Montana			Localities can develop disposal plan.
Nebraska	YES		
Nevada	NO		Landfills must separate white goods for recycling. ***
New Hampshire			Landfills must separate white goods for recycling. ***
New Jersey			Landfills must separate white goods for recycling. ***
New Mexico			Landfills must separate white goods for recycling. ***
New York			Landfills must separate white goods for recycling. ***
North Carolina	YES	$3.00 per unit	
North Dakota	YES		
Oregon	YES		
Rhode Island	YES		
South Carolina	YES	$2 for White Goods (paid by Wholesalers)	
South Dakota	YES		Fee up to landfill.**
Texas			Landfills must separate white goods for recycling.***
Vermont	YES		
Virginia			Landfills decide whether to accept white goods.
Washington			Localities are required to develop individual solid waste disposal plans.
West Virginia			Landfills decide whether to accept white goods.
Wisconsin	YES		
Wyoming			Landfills decide whether to accept white goods. If no proof of freon removal, a fee is charged.
TOTAL	***19***		

* Fee paid at the time of appliance purchase, which may be channeled back to the localities for assistance in recycling.

** Fee charged at the time of disposal to help defray costs associated with white good recycling.

*** While there is no state law banning all white goods from municipal waste sites, there may be restrictions in the way white goods are handled, including separation so that they may be channeled to recycling facilities.

In 2003, an estimated 2.4 million metric tonnes were sent for recycling or disposal. The Appliance Recycling Information Center (ARIC) estimates that nationwide, 89.7 percent of major appliances reaching the end-of-life were recycled in 2003. The percentage is higher still for states with landfill bans or other restrictions on disposing of appliances.[8]

In North Carolina for example, a white goods disposal tax was imposed in 1993 (originally at the rate of $10 per item that contained Freon and $5 for items without Freon. Since 1998 there has been a reduced tax of $3 for all white

[8] Appliance Recycling Information Center, INFOBulletin #1: Recycling Major Home Appliances.

goods). The white goods disposal tax is collected at the point of sale of new white goods. Retailers remit funds to the NC Department of Revenue.

Each quarter the Secretary of Revenue will distribute the net taxes collected, after deducting the Department's allowance for administrative expenses and refunds as follows: 8% to the Solid Waste Management Trust Fund, 20% to the White Goods Management Account and 72% among the counties on a per capita basis[9].

A major accomplishment of the white goods program has been the drastic reduction in illegal dumping of white goods. Over the past eight years the number of white goods managed by the counties has nearly doubled.

The system of recycling in the United States is largely driven by the economics of the recovery and return of metallic materials. Even when scrap steel prices are depressed (as was evident in 2000-2002) the recycling rates remained in the 80+% range. The current municipal, retailer, and individual entrepreneur infrastructure maintains a very high recycling rate across the U.S.

4.4 Australia

In Australia, there is no national legislative framework to address the recovery or recycling of end-of-life white goods. The four electrical associations (the Australian Electrical and Electronic Manufacturers' Association (AEEMA), the Consumer Electronics Suppliers Association (CESA), the Australian Information Industry Association (AIIA) and the Australian Mobile Telecommunications Association (AMTA)) are currently developing a "Product Stewardship Strategy for Electrical and Electronic Equipment". A working group comprised of Commonwealth and State Governments and wider industry organizations is guiding their work. This Strategy will address all environmental loads incurred during the life of the product including material efficiencies and recovery at end-of-life. The Strategy will address issues relating to major appliances.

Current options for major appliance disposal vary between Australian states and territories, and between metropolitan and non-metropolitan areas. Some areas are undertaking innovative schemes to encourage re-use and recycling, and others merely dumping major appliances at the local landfill. These differences occur for many reasons, including geographic location, population size, the existence (or lack) of facilities for waste collection and treatment, the resources available for the development of facilities, and political priorities.

It is estimated that approximately 60 percent to 70 percent of major appliances are recovered for metal recycling, with recycling rates being slightly higher in metropolitan areas. While this is a fairly high figure, it should be noted that there is very little recovery of any other materials from appliances.

[9] White Goods Disposal Tax, Section 29, North Carolina Department of Revenue, February 1, 2004.

Of the remaining 30 to 40 percent of appliances that are not recovered for recycling, the majority is landfilled.[10]

[10] Environment Australia, Major Appliances Materials Project, http://www.deh.gov.au/industry/waste/electricals/majorappliances.html, Sept. 2001

5. Generation and Material Composition

5.1 Life Span

Average life span is based on the 26th Annual Portrait of the U.S. Appliance Industry, published by the magazine, *Appliance,* in September 2003. The estimates represent the expert judgment of the magazine's staff based on input from many sources. This list shows the low, high and average life expectancy of appliances in the U.S. Life expectancy refers to "first owner use" only. It does not take into account extended product life attributable to recovery and/or resale of second-hand appliances.

With the exception of refrigerators, "average" life expectancy figures were used for all appliances based on the assumption that the majority of appliances enter the waste stream at the end of first owner usage. Refrigerators are more likely to be kept on as second units and for this reason the "high" life expectancy figures are assumed for this report.

Estimated average life-spans are as follows:

- ✧ Refrigerators 16 years
- ✧ Freezers 11 years
- ✧ Dishwashers 8 years
- ✧ Gas ranges 14 years
- ✧ Electric ranges 14 years
- ✧ Clothes washers 12 years
- ✧ Clothes dryers 13 years

5.2 Number Of Waste Units Available Based on Original Sales Data

The number of units entering the waste stream can be estimated using historic shipment data as provided in publications of the *Canadian Appliance Manufacturers Association (CAMA)*, most notably the *Annual Major Appliance Industry Trends & Forecast.*

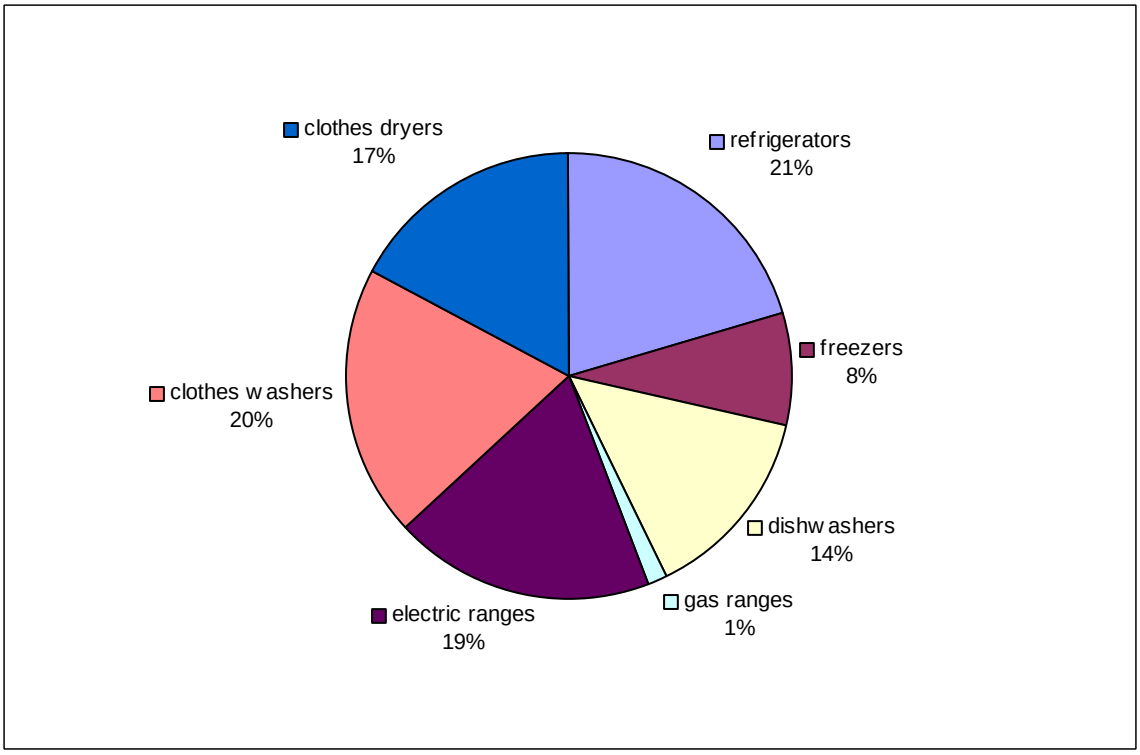
Quantities projected for each year (between 2002 and 2007) are based on original shipment data for the year represented by current year minus the assumed life expectancy of units within each product category. For example, the average dishwasher life is eight years so 2002 waste is based on 1994 data (2002 – 8yrs) for shipments and average weight.

For the year 2002, the estimated number of retired units that entered the waste stream are:

- ✧ Refrigerators 575,000
- ✧ Freezers 230,000

- ✧ Dishwashers 393,000
- ✧ Gas ranges 40,000
- ✧ Electric ranges 527,000
- ✧ Clothes washers 554,000
- ✧ Clothes dryers 483,000
- ✧ **Total all units 2,802,000**

FIGURE 1 Percentage of End-of-Life White Goods per Category



The quantities of waste and recyclable materials associated with white goods entering the municipal waste stream in Canada annually have been calculated using a number of sources and assumptions as detailed below. Key considerations include:

- ✧ Average life-span of appliances by product category;
- ✧ Number of units available based on original sales data;
- ✧ Average weight per unit; and,
- ✧ Material composition by product category.

Table 5.1 indicates the amount of material derived from white goods that can be expected to enter the waste stream each year over a five-year period. Projected tonnages are provided for each type of appliance together with a summary totaling all product categories.

TABLE 5.1 White Goods Materials entering Waste Stream 2002-2007

Year	2002	2003	2004	2005	2006	2007
Annual shipments (,000 units)	2802	2766	2850	2846	2935	2892
Total weight (tonnes)	209487.2	210553.5	218971.0	212901.2	216543.3	206542.6
Material	**tonnes**	**tonnes**	**tonnes**	**tonnes**	**tonnes**	**tonnes**
Steel	133352.8	133572.2	137565.1	133703.3	136529.0	130748.0
Iron	6799.2	7092.3	7629.6	7312.8	7375.5	6921.6
Sub-Total: Ferrous Metal	**140152.0**	**140664.4**	**145194.8**	**141016.1**	**143904.5**	**137669.5**
Aluminum	7756.6	7507.5	7798.8	7855.1	8008.1	7424.9
Copper	6879.8	6913.8	7223.6	7072.5	7149.0	6739.7
Brass	271.2	267.2	284.4	285.6	282.7	286.2
Other Metal	2042.2	2052.1	1993.0	1862.2	1960.8	1914.7
Sub Total: Non-Ferrous Metal	**16949.9**	**16740.6**	**17299.9**	**17075.4**	**17400.6**	**16365.5**
Rubber	1414.7	1328.9	1383.3	1422.6	1443.3	1315.2
Fiber & Paper	177.6	177.4	187.7	188.5	186.4	186.3
Polypropylene	12888.9	11652.6	11958.7	12719.2	12720.8	12174.2
PS&HIPS	5004.9	5592.6	6386.3	5989.5	5938.6	5582.0
ABS	3329.2	3734.3	4222.6	3953.7	3972.0	3726.8
PVC	1724.6	1730.9	1872.2	1860.6	1832.3	1795.9
Polyurethane	6850.9	7543.1	8459.8	7752.9	7641.6	7081.7
Other Plastics	3305.8	3631.5	4092.1	3834.9	3814.1	3574.1
Asst. Mixed Plastics	3256.3	3279.5	3471.1	3386.1	3409.4	3259.9
Sub Total: Plastic	**36360.6**	**37164.4**	**40462.8**	**39496.9**	**39328.8**	**37194.6**
Fiberglass	4875.7	4770.1	4577.5	4342.2	4589.5	4547.2
Glass	6060.6	6287.6	6440.7	5986.7	6202.7	6035.3
Sub Total: Glass	**10936.3**	**11057.8**	**11018.1**	**10328.9**	**10792.2**	**10582.4**
Refrigerant (typically removed)	127.5	138.8	152.6	139.0	137.5	127.2
Oil (typically removed)	431.9	426.8	452.6	448.8	458.5	407.8
Other Materials (typically removed)	0.0	0.0	0.0	0.0	0.0	0.0
Typically Removed	0.0	0.0	0.0	0.0	0.0	0.0
Before Processing	0.0	0.0	0.0	0.0	0.0	0.0
Sub Total: Materials Typically	**559.4**	**565.6**	**605.2**	**587.8**	**596.0**	**535.0**
Removed Before Processing	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0
Other	3134.1	2989.0	2995.5	2984.6	3095.1	2853.9
Total *	**209684.6**	**210688.0**	**219147.2**	**213100.9**	**216747.0**	**206702.6**

Appliance Content Information Courtesy of the Association of Home Appliance Manufacturers
Appliance Lifespan Information Courtesy of APPLIANCE Magazine
Appliance Shipment Information Courtesy of the Canadian Appliance Manufacturers Association, Electro-Federation Canada
Variance between total weight in tonnes (line 4) and total tonnes (last line) due to automatic rounding errors

In 2002 about 2.8 million white goods weighing 209,685 tonnes entered the municipal waste stream in Canada. Based on Canadian population and housing statistics, that represents about one appliance for every four households, or 7.1kg of white goods per person per year[11].

TABLE 5.2 New Appliance Sales by Retail and Builder Sales Channels

Product	Sales channel	1998	1999	2000	2001	2002
Refrigerators	Retail	648	658	628	722	797
	Builder	156	162	168	155	177
	Total	**804**	**820**	**796**	**877**	**974**
Electric Ranges	Retail	393	444	448	465	524
	Builder	115	122	128	135	162
	Total	508	566	576	600	686
Gas Ranges	Retail	61	57	54	45	56
	Total	**569**	**623**	**630**	**645**	**742**
Automatic Washers	Retail	553	589	590	607	657
	Builder	50	59	67	67	80
	Total	603	648	657	674	737
Wringer Washers	Retail	n/a	n/a	n/a	n/a	n/a
	Total	**603**	**648**	**657**	**674**	**737**
Electric Dryers	Retail	422	449	456	490	538
	Builder	42	51	57	59	70
	Total	464	500	513	549	608
Gas Dryers	Retail	40	37	31	21	25
	Total	**504**	**537**	**544**	**570**	**633**
Dishwashers	Retail	353	395	399	416	488
	Builder	61	68	70	67	83
	Total	**414**	**463**	**469**	**483**	**571**
Freezers	**Total (retail)**	**230**	**229**	**231**	**231**	**235**
Retail total		**2700**	**2858**	**2837**	**2997**	**3320**
Builder total		**424**	**462**	**490**	**483**	**572**
Grand total		**3124**	**3320**	**3327**	**3480**	**3892**
Builder as a percent of total		**14%**	**14%**	**15%**	**14%**	**15%**

[11] Statistics Canada, Private Households by Structural Type and Dwelling, 2001 Census, http://www.statcan.ca/english/Pgdb/famil55a.htm

Source: Canadian Appliance Manufacturers Association, Industry Trend and forecast Report

Multiplying the estimated number of appliances at the end of their life span by the estimated average weight derives the tonnage. This is further broken out by material -- metals, plastics, glass, others – according to the percentage of each type found in each type of appliance.

Appliances contain about 50 kilograms of ferrous metals. The single largest material component of white goods is steel, which accounts for about 65 percent by weight, however, this varies considerably by appliance category[12].

Table 5.2 shows historic white good sales over five years up to and including 2002. Builder sales, which account for about 15 percent of total sales, include sales to homebuilders, motels, governments, row house builders, trailer manufacturers and apartment homebuilders.

5.3 Material Composition

The material composition of individual appliance categories is based on the *Material Composition Study*, *Association of Appliance Manufacturers (AHAM), 1997*. GE, Whirlpool, Maytag and Electrolux jointly funded the research. Samples of representative models of the products listed were provided by the respective companies and shipped to WtE Corporation in Boston who conducted a tear down analysis. The American Plastics Council volunteered the use of their IR scanning machine to determine the composition of the plastics. The results were reviewed and approved by each of the companies prior to publication of the final report.

During the 1960s and 1970s design modifications within some categories of household appliances resulted in substitution of plastics for metal parts and housings. However, manufacturers advise that the change in the relative percentages of materials from the mid 1980s to 1997 has been minimal. For this reason the conclusions of the1997 compositional analysis are pertinent to white goods currently entering the municipal waste stream.

It is estimated that the steel used to make white goods is itself about 25-28 percent recycled content[13]. White goods also contain roughly 20 percent plastics[14] and other materials used for insulation. Table 5.3 shows the average material composition of household appliances. A more detailed breakdown by appliance category can be found in Appendix I.

The results of a simple equipment deconstruction exercise conducted on a refrigerator and a clothes dryer at a City of Toronto Public Works Yard in November 2003 are relatively consistent with the conclusions of the 1997 AHAM

[12] Steel Recycling Institute (SRI), http://www.recycle-steel.org/appliances/index.html
[13] ISRI, URL:http://www.isri.org/industryinfo/earthday/stats.htm
[14] Ibid

study. However, as predicted, the 1970s refrigerator is higher in ferrous metal content than present day models (see Table 5.4).

TABLE 5.3 Material Composition of White Goods by Percent (1997)

	Refrigerators (top/bottom)	Refrigerators (side by side)	Freezers	Dishwashers	Gas Ranges	Electric Ranges	Clothes Washers	Clothes Dryers
Average weight (lbs)	186.2	245.9	124.6	67.8	178.1	105.8	146.8	93.1
Ferrous metal	61.7%	58.7%	71.3%	49.5%	87.4%	70.0%	66.2%	82.0%
Non-ferrous metal	6.2%	5.8%	6.6%	9.0%	2.9%	6.3%	12.4%	8.9%
Rubber	0.2%	0.4%	0.1%	1.4%	0.0%	0.1%	2.0%	0.3%
Fibre and paper	0.1%	0.2%	0.0%	0.3%	0.0%	0.0%	0.0%	0.2%
Plastics	27.8%	30.2%	21.2%	37.4%	1.2%	2.2%	15.6%	6.1%
Glass	3.5%	4.2%	0.2%	1.1%	11.1%	18.4%	1.0%	0.8%
Materials typically removed	0.3%	0.2%	0.6%	0.0%	0.0%	0.0%	0.6%	0.1%
Other	0.1%	0.4%	0.0%	1.3%	0.4%	2.7%	3.5%	0.5%

Source: *Material Composition Study*, *Association of Appliance Manufacturers (AHAM), 1997*. GE, Whirlpool, Maytag and Electrolux jointly funded the research. Tear down analysis conducted by WtE Corporation in Boston. IR scanning machine determine the composition of the plastics.

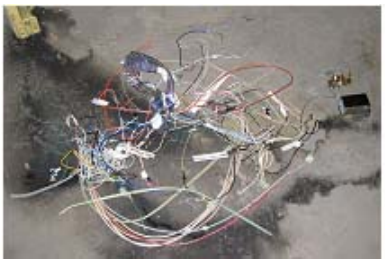
TABLE 5.4 Material Composition – 1970s GE Talisman Refrigerator

Material	Weight (lbs)	Weight (kgs)	Composition (%)
Ferrous metals	191.5	86.9	78%
Non-ferrous metals	28	12.7	11%
Plastics	12	5.4	5%
Insulation and other	14.8	6.7	6%
Total	**246.3**	**111.7**	**100%**

Plates 1 – 9 Photos of the deconstruction of a 1970s GE Talisman refrigerator in Toronto, November 2003

These photographs document components that were disassembled as part of a teardown analysis conducted on a 1970s GE Talisman refrigerator at a City of Toronto Public Works yard in November 2003. Findings were relatively consistent the conclusions of a 1997 compositional study by the Association of Home Appliance Manufacturers. However, as expected, the ferrous metal content was higher than is found in most units coming out of service today.


Top row: total unit - 108.9 kg., ferrous metal shell – 42 kg., non ferrous trim – 3.6 kg


Middle row: ferrous compressor 12 kg, copper and aluminum coils and cooler – 8.6 kg., PVC coated copper wiring - .9 kg., ferrous screws, bolts, fasteners – 2.5 kg.



Bottom row: plastic door moldings – 5.4 kg., Other plastic seals and moldings - .45 kg., fiberglass insulation 1.3 kg. Not shown: ferrous door panels, drawers/shelves.

5.4 Average Weight

The typical weight of an appliance entering the waste stream in 2002 is about 74.8 kg.

Average weights for individual appliance categories were determined by examining manufacturers' historic marketing materials at five-year intervals (e.g. 1985, 1990, etc.). These weights have been subsequently averaged out for the intervening years. Because most marketing literature provides only shipped weights, the weight of each item has been reduced by 10 percent to account for packaging.

The total tonnage is obtained by multiplying the number of shipments by the average weight per unit for the same year.

6. Packaging

6.1 Generation

Identifying the amount of packaging that will enter the municipal and industrial/commercial/institutional waste streams in any given year requires a detailed and complex analysis of sales by individual product for every manufacturer. This is the nature of information now being requested by stewardship programs such as the Blue Box Plan in the Province of Ontario. However, as there are upwards of 7,000 individual products in the marketplace, it is beyond the scope of this paper to provide an exhaustive compositional analysis.

Instead, as shown in Table 6.1, typical weights have been adopted by general product category – refrigerators, ranges, dishwashers, etc. – based on generalized data for the more popular sizes of these products.

It is estimated that the typical weight for all new appliance packaging sold in Canada is about 6.32 kilograms of which about 72 percent is corrugated cardboard and that the total weight of packaging (in year 2002) was roughly 24,587 tonnes.

It should be noted that the composition of packaging associated with new appliances is changing. For example, the use of wooden delivery pallets has been reduced considerably in recent years. Polyethylene shrink-wrap is used increasingly to replace corrugated cardboard.

TABLE 6.1 Typical Packaging Weights per Appliance Category (2002)

	Material	kg / unit	# units	Total kg	tonnes
Ranges					
	Cardboard	6.46	742,000	4,795,274	4,795
	Foam	0.11	742,000	84,702	85
	Plastic	0.21	742,000	152,128	152
	Tape	0.02	742,000	13,911	14
	Wood	2.99	742,000	2,221,333	2,221
19%	**Total**	**9.79**	**742,000**	**7,267,347**	**7,267**
Washers					
	Cardboard	5.903	737,000	4,350,511	4,351
	Foam	0.135	737,000	99,495	99
	Wood	0.702	737,000	517,374	517
19%	**Total**	**6.74**	**737,000**	**4,967,380**	**4,967**
Dryers					
	Cardboard	5.754	633,000	3,642,282	3,642
	Foam	0.118	633,000	74,694	75
	Wood	0.24	633,000	151,920	152
16%	**Total**	**6.112**	**633,000**	**3,868,896**	**3,869**

	Material	kg / unit	# units	Total kg	tonnes
Dishwashers					
	Cardboard	3.69	571,000	2,109,436	2,109
	Foam	0.09	571,000	49,252	49
	Plastic	0.11	571,000	64,041	64
	Wood	1.29	571,000	737,040	737
15%	**Total**	**5.18**	**571,000**	**2,959,768**	**2,960**
Side by Side Refrigerators					
	Cardboard	12.70	126,000	1,600,274	1,600
	Foam	0.35	126,000	44,008	44
3%	**Total**	**13.05**	**126,000**	**1,644,281**	**1,644**
***Top/Bottom Mount Refrigerators**					
	Cardboard	1.08	848,000	913,296	913
	Foam	1.63	848,000	1,385,632	1,386
	Plastic	0.82	848,000	691,120	691
	Tape	0.03	848,000	23,744	24
	Steel	0.03	848,000	23,744	24
22%	**Total**	**3.58**	**848,000**	**3,037,536**	**3,038**
***Freezers**					
	Cardboard	1.08	235,000	253,095	253
	Foam	1.63	235,000	383,990	384
	Plastic	0.82	235,000	191,525	192
	Tape	0.03	235,000	6,580	7
	Steel	0.03	235,000	6,580	7
6%	**Total**	**3.554**	**235,000**	**835,190**	**835**
Total all categories					
	Cardboard	**4.54**	**3,892,000**	**17,664,167**	**17,664**
	Foam	**0.55**	**3,892,000**	**2,121,773**	**2,122**
	Plastic	**0.28**	**3,892,000**	**1,098,813**	**1,099**
	Wood	**0.93**	**3,892,000**	**3,627,666**	**3,628**
	Tape	**0.01**	**3,892,000**	**44,235**	**44**
	Steel	**0.01**	**3,892,000**	**30,324**	**30**
100%	**Total**	**6.32**	**3,892,000**	**24,586,979**	**24,587**

6.2 Packaging Recovery

A small percentage of the packaging associated with white goods actually enters the municipal solid waste stream – approximately 16 percent.

Because of the large size and heavy weight, most customers elect to have new appliances delivered. The overwhelming majority of major and independent retailers surveyed either take back packaging materials for recycling and/or disposal after uncrating or they defrock the packaging at the warehouse/ distribution center prior to shipping. Defrocking prior to delivery also provides an opportunity for visual product checks, improved quality control and reduced delivery time. While a number of retailers charge customers a service fee for the removal of old appliances from their customers' premises, packaging recovery is generally provided at no cost.

In order to determine the percentage of white goods packaging requiring municipal services for disposal/recycling, a number of factors must be considered including:

- ✧ Percentage of appliances sold to the public vs. builder sales (home builders, motels, governments, row house builders, trailer manufacturers and apartment house builders). In 2002, builder sales accounted for 15 percent of total sales. 100% of packaging from these sales is managed by the builder trade or wholesale delivery agent and does not enter the municipal waste stream;
- ✧ Market share of those businesses that recover packaging and the percentage of packaging they take back; and,
- ✧ Market share of those businesses that do not take back their packaging.

The findings summarized in Table 6.2 are based on written and telephone surveys conducted with 11 major retailers operating more than 3,665 locations and with sales greater than $500 million each. 27 independent retailers with 52 locations across Canada were also surveyed. Only two major retailers failed to provide information and only one independent declined to participate in the research.

Approximately 5 percent of retail appliance sales are cash and carry. The packaging associated with these sales likely requires municipal recycling or disposal services. For this reason estimated retailer take-back numbers have been adjusted down five percent accordingly.

It is estimated that about 84 percent of appliance packaging is managed through major and independent retail programs and the builder market. This leaves about 16 percent to be managed through municipal recycling and disposal services. According to 2002 generation data in Table 6.1, this equates to approximately 3,394 metric tonnes.

TABLE 6.2 White Goods Packaging Diversion from Municipal Solid Waste Stream (2002)

1. Amount managed by builder trade/market					
					15%
2. Amount managed by major retailers (gross sales > $500 million/ann)					
Company[1]	**Number of locations**	**Market share**[2]	**Customer take-back**[3]	**Advance defrocking**	**Net packaging managed**
A	54	4.5%	13%		0.59%
B	63	2.0%	95%		1.90%
C	100	2.4%	95%		2.28%
D	2100	33.4%	88%		29.39%
E	78	6.3%	95%		5.99%

Company[1]	Number of locations	Market share[2]	Customer take-back[3]	Advance defrocking	Net packaging managed
F	1000	1.5%	50%		0.75%
G	103	1.4%	95%		1.33%
H	119	2.6%		95%	2.47%
I	25	2.3%	95%		2.19%
J[4]	?	0.6%	?	?	-
K[5]	23	7.7%	85%		6.55%
Total	**3665**	**65%**			**53%**
3. Amount managed by independent retailers					
Company	**Number of locations**	**Market share 20%**	**Customer take-back**	**Advance defrocking**	**Net packaging managed**
AMG Appliances	1		28%		
Shuh Appliances	1		95%		
Smith Vernon Furniture & Appliances	1		95%		
Domaine	1		95%		
Allen's Furniture Warehouse	1		95%		
Blacks FW Ltd.	1		95%		
Shaw's Furniture & Appliances	1		95%		
Metro Karges Appliances	1		95%		
TA Appliance Warehouse	1		95%		
Tepperman's Furniture Appliance	6		95%		
Colonial Furniture	4		95%		
Abrams Leo P & Son Inc	1		95%		
Bad Boy	5		No		
Bains Appliance Parts and Service	1		No		
Dufresne Furniture & Appliances	2			95%	
Kern-Hill Furniture Co-op Ltd.	1		95%		
Atlas Appliances	1		95%		
Bestway Television and Appliances	1		94%		
Trail Appliances	11			95%	
Best Appliance Centre	1		95%		
Bi-Rite Furniture Warehouse	2		95%		
City Furniture (Pg) Ltd	1			95%	
Northern Hardware and Furniture Co	2		95%		
R K Furniture Gallery	1			95%	
Ben's Direct Maytag Home Appliance Center	1		95%		
Westcoast Appliance	1			95%	
Stockli Maytag Home Appliance Ctr	1			95%	
Total	**52**	**20%**	**=46 locations (88%)**		**16%**

4. Total percentage of packaging managed by			
	Market share	**Recovery rate per sector**	**Net amount handled**
Wholesale -Builder trade/market	15%	100%	**15%**
Major retailers	65%	81%	**53%**
Independent retailers	20%	80%	**16%**
Municipal recycling/disposal services	NA	NA	**16%**
			100%

Note [1]: Company name withheld due to confidentiality of sales/market information. All companies submitted written survey data except companies H and I who were interviewed by telephone

Note [2]: Market Share information based on Trendex Independent Quarterly Market Reports for 2002 except companies B and F

Note [3]: Customer take back percentages have been modified down from reported numbers by 5 percent to allow for cash and carry purchases

Note [4]: Major retailers not participating in study

Note [5]: Quebec locations only, packaging not recovered at 2 of 23 stores

7. Municipal White Goods Recovery Programs

Photograph of white goods taken at the City of Banff Public Works Yard.

The information in this section reflects data collected in the national municipal survey (see Appendix B). Sent in both English and French languages, the survey was designed to:

- Determine types of collection programs;
- Levels of service;
- Quantities managed;
- End markets; and,
- Costs and revenues where available.

In consideration of the Federal Privacy Act, national contact information for municipal waste management officials is no longer made available through the Federation of Canadian Municipalities (FCM). Instead, provincial contact lists were assembled with the assistance of the Recycling Councils of British Columbia and Alberta, the Saskatchewan Waste Reduction Council, Resource Conservation Manitoba, the Association of Municipal Recycling Coordinators, Association des Organismes Municipaux de Gestion des Matièresvarious, as well as provincial environment ministry officials in Atlantic Canada. This information was augmented with a municipal contact list from the FCM publication, *A National Consultation on the Management of Discarded Electronics, April 2003.* The three Northern territories of Yukon, Northwest Territories and Nunavut were not included in the study due to their comparatively sparse populations.

7.1 Survey Participation Rates

Across Canada, 74 municipal programs participated in the survey (see Appendix C). 24 of these programs represented groups of municipalities organized under regional, county or other cooperative administrative structures. Together these programs represent 48 percent of the national population.

Of the top 20 largest population centres in Canada, Quebec City (pop. 683,000) was the only major urban centre that did not respond. All other non-respondents would be small to medium-sized communities with populations predominantly under 100,000.

As indicated in Table 7.1, survey participation rates varied considerably by province. This is attributed in part to the quality of the mailing lists provided, but also likely reflects higher response rates in those jurisdictions where white goods programs exist. The Province of Prince Edward Island, with a population of only 133,000 is considered to have 100 percent survey participation rate because municipal waste management services there are provided by a single agency.

In the Province of Quebec, only the Cities of Laval, Montreal and Sherbrooke completed surveys, however, a profile of bulky (cumbersome) goods programs in 96 Quebec municipalities was made available through Association des organismes municipaux de gestion des matières résiduelles.

TABLE 7.1 Survey Participation Rates by Province (percentage of population)

	Populations in participating communities	Actual population by province	% Participating
British Columbia	2,889,808	3,858,730	75%
Alberta	1,950,965	2,918,920	67%
Saskatchewan	447,200	956,630	47%
Manitoba	700,994	1,090,625	64%
Ontario	5,341,352	11,254,730	47%
Quebec	2,291,000	7,097,855	32%
New Brunswick	122,800	717,535	17%
Nova Scotia	227,528	895,310	25%
Newfoundland	133,039	507,245	26%
Prince Edward Island	133,070	133,070	100%
Canada	**14,234,686**	**29,522,305**	**48%**

Breakdown of municipal survey respondents by size of population**:**

- ✧ 3 programs with populations > 1 million;
- ✧ 4 programs with populations between 500,000 and 1 million;
- ✧ 20 programs with populations between 100,000 – 500,000;
- ✧ 10 programs with populations between 50,000 – 100,000; and,
- ✧ 35 programs with populations < 50,000

7.2 Overview of Municipal White Goods Recovery Programs

Most communities participating in the survey report having some form of white goods recovery programs. 13 communities reported sending some white goods for disposal in landfill sites; however, none were able to quantify the amount.

In the British Columbia, the Province's Landfill Criteria for Municipal Solid Waste [15] expressly prohibits white goods from disposal in all but a few "Selected Landfill Sites." This requirement means that most BC communities have a white goods recovery program of some sort.

In the rest of the country only one community, the City of London, reported having a landfill ban on white goods. In that community, householders are responsible for finding their own private sector white goods recycling or disposal mechanisms, as the City does not provide disposal or recycling services for this waste stream.

Most municipalities arrange to have ozone depleting substances (ODS) purged and recovered from white goods prior to recycling or disposal as required by federal and provincial laws, however, 8 municipalities did not indicate that this was part of their white goods management program. This may be an oversight because it is left up to recycling contractors in those communities, as is typical in the majority of other programs.

Contractors reportedly charge municipalities between $7.50 and $25 per unit to manage the Chlorofluorocarbons (CFCs) found in refrigerators and freezers. However, the financing arrangements vary considerably from one program to another.

Program design also varies from one jurisdiction to the next although most communities provide drop off depots for white goods. Some communities provide curbside collection of white goods either by advance arrangement (telephone request), or on designated bulky goods collection days such as spring or fall clean-up days. Understandably, regular curbside collection service is more common in larger municipalities; however, even communities with

[15] Landfill Criteria for Municipal Solid Waste, British Columbia Ministry of Water, Air and Land Protection, http://wlapwww.gov.bc.ca/epd/epdpa/mpp/lcmsw.html

populations less than 50,000 offer curbside collection on selected special days of the year.

Whether white goods are picked-up or are dropped off by the householder, there is almost always a user fee charged to help offset municipal ODS management fees and other handling costs. These fees are typically $20 per unit for refrigerators and freezers and $10 for other categories that do not contain ODSs.

Ascertaining the total quantity of white goods recovered through municipal programs is difficult. 47 programs reported that they track the quantities of white goods they recover while 27 do not. The quality of data provided varies considerably from one program to another. As explained in Section 7.4, Municipal Diversion Quantities, there are no standard measurement protocols for tracking white goods diversion and information is often provided in different units of measurement. For these reasons data is subject to considerable interpretation.

Using formulas to normalize municipal data into kilograms recovered, it is estimated that municipalities participating in the survey diverted 30,024 tonnes of white goods in 2002. This translates into an average recovery of 2.26 kg per capita in communities that have white goods recovery programs or 2.11 kg per capita for all reporting programs. If this level of recovery is considered representative of all municipal programs in the country, then total municipal diversion of white goods in Canada in 2002 would be approximately 62,500 tonnes.

Municipal recovery rates are generally higher in smaller communities. This is likely due to the absence of retail and private sector collection infrastructures that exist in larger centres. Recovery rates in non-reporting communities are likely to vary from the average in reporting communities. Because non-reporting communities may be further from scrap metal markets and may lack the resources to implement separation programs, the percentage of diversion programs may be lower.

Using various participation and performance assumptions for these communities (page 60), it is estimated that total municipal diversion of white goods is between 54,851 and 80,687 tonnes. This does not include municipal tonnage diverted by private entrepreneurs. Without more in depth study involving non-reporting communities, any assumptions regarding performance of white goods programs in these communities are strictly arbitrary.

In total, municipal programs are thought to divert between 26 and 38 percent of end-of-life white goods entering the municipal solid waste stream in 2002.

7.3 Municipal Program Design

The first municipal white goods recovery programs started in the mid 1970s (E.g. Calgary, AB and Nipawin, BC). Others began during the 1980s; however, the

majority of programs are fairly recent, having started in the 1990s, after the introduction of regulations governing ozone-depleting substances in white goods.

Jurisdictions that reported having no form of municipally operated white goods recovery programs (10 out of 74) represented 4 percent by population of all survey respondents. Reporting communities without white goods programs are as large as 350,000 population and as small as 1,500. Size of community did not appear to be a determinant in whether or not the community had a program.

Following are municipalities that report that they do not collect white goods for recycling:

- Lethbridge, District of Peace, and Cold Lake, AB;
- Columbia Shushwap, BC;
- Cornerbrook, NF;
- North Bay, Minden Hills, Minto, Rideau Lakes, and London, ON; and,
- Laval, PQ

Communities provide varying levels of white goods collection service. By far the most common form of service is the permanent depot facility, usually located at a municipal landfill site or transfer station. This is especially true of provinces West of Ontario. Depots generally have set hours of operation that correspond to the hours of operation of the facilities in which they are located. In smaller communities hours of operation tend to be more restricted.

Communities also offer curbside collection of white goods, either on a weekly, bi-weekly, monthly or seasonal basis. This is especially true in the Provinces of Ontario, Quebec and Nova Scotia. However, Ontario communities tend to offer more frequent collection whereas Nova Scotia communities offer special collection days at different times of the year.

Population within a community also tends to determine the level of service provided. In large communities with over one million in population, three of four communities report that they provide regular curbside pick-up by prior arrangement in addition to their permanent depot

Only the communities of Laval, PQ; Sudbury, ON and Vancouver, BC reported that they provide regular collection of white goods without prior arrangement. Interestingly both the Cities of Laval and Winnipeg report that private sector operators scavenge a high percentage, of units placed at the curb in advance of municipal collection vehicles. Anecdotal information from other municipalities indicates this is a common phenomenon in curbside collection communities. For the purposes of this report it is assumed that approximately 50% of units placed at the curbside for either recycling or garbage disposal are ‘unofficially’ diverted by private sector entrepreneurs.

Tables 7.2 and 7.3 indicate types of programs implemented in various jurisdictions.

TABLE 7.2 Types of Municipal Recovery Programs by Province

Province	# Programs reporting	Occasional depot(s)	Permanent depot(s)	Regular curbside by arrangement	Curbside seasonal collection days	Curbside weekly garbage collection
*BC	11		8	1	1	1
AB	12	1	7		2	
SK	5		5			
MB	4		4	1		
ON	24		14	11	1	1
**PQ	3		2	1		1
NB	2		2			
NS	9		3	2	5	
PEI	1		1			
NL	3		2	1	2	
	74	**1**	**50**	**17**	**11**	**3**

**Note: 19 communities within the Greater Vancouver Regional District (GVRD) counted as one program, however there are significant variances between service areas.*
*** Collection of white goods in many Quebec communities is predominantly through curbside collection, however, this was not reflected in the limited survey responses from Quebec.*
****Note: the types of programs listed exceed the total number of programs because some jurisdictions provide various levels of service to their residents.*

TABLE 7.3 Program Type by Size of Population

Province	# Programs reporting	Occasional depot(s)	Permanent depot(s)	Regular curbside by arrangement	Curbside seasonal collection days	Curbside weekly garbage collection
> 1 million	4		3	3	1	1
500,000 and 1 million	5		5	2	1	2
100,000 – 500,000	20		9	8		1
50,000 – 100,000	10		6	1	1	
< 50,000	35	1	22	2	8	
	74	**1**	**50**	**16**	**11**	**4**

**Note: Larger communities over 500,000 often tend to represent an amalgamation of smaller communities within their jurisdictions. Within large communities, multiple examples of a program type are indicated only as 1 program in this table.*

The Province of Quebec reportedly has a significant number of curbside collection programs for the recovery of white goods. According to information provided by the Association des organismes municipaux de gestion des matières résiduelles (AOMGMR), an organization consisting of 60 Quebec municipalities that provides technical support to elected officials and waste managers, there are 73 curbside collection programs located in 96 communities. In fact, 27 of the 96 are communities that make up the City of Montreal. In addition, 14 municipalities provide special collection days at various times during the year.

By contrast, the study only identifies 6 communities that collect white goods through permanent depots or eco-centres. No tonnage or cost data was provided so a reliable assessment of quantities diverted or effectiveness of programs in Quebec was not possible.

The Greater Vancouver Regional District, population 1,987,000, is shown in this report as one program. However, within the GVRD there are 19 separate jurisdictions, 15 of which have white goods recovery programs of some type.

Of the GVRD's 15 programs, 13 offer drop-off at permanent depots (including landfill and transfer stations), three collect at curbside given prior arrangement, three have seasonal collection days, while one, Vancouver proper, sorts white goods from a mixed collection waste stream. Of note, at least three GVRD municipalities do not accept refrigerators or freezers. Residents must send these to BC Hydro or a private sector recycler.

Since 1990 BC Hydro has offered a financial incentive to residents to encourage them to retire their 'second' refrigerators[16.] The incentive, formerly $50, now $30 per unit, is mailed to residents a number of weeks after BC Hydro collects it from the resident's home. The refrigerators are shipped to BC Hydro's appliance dismantling facility just outside Vancouver. This energy saving program applies to operational refrigerators only. Chlorofluorocarbons, oil and other fluids are safely drained and recovered. The hulks are then sent to area metal recyclers. Between 1990 and 1999 the program recovered 160,000 operating refrigerators. The program will operate until August 2004 unless extended.

7.4 Municipal Diversion Quantities

Municipal record keeping of quantities of white goods recovered varies considerably. Of the 64 surveyed programs that collect white goods, only 47 track quantities managed.

Municipalities were asked to provide quantities tracked using any of the following units of measurement:

[16] BC Hydro Power Smart Refrigerator Take Back Program, http://www.bchydro.com/news/2003/sep/release8481.html

- ✧ Number of units tracked;
- ✧ Weight in kilograms/tonnes;
- ✧ Weight in pounds/tons.

In most cases data was provided using more than one system of measurement. Municipalities often had reliable information on the refrigerators and freezers they collect because they are required to pay contractors on a per-unit basis for the purging and management of ozone depleting substances. However, more often than not, other categories of white goods were mixed with municipally generated scrap metal materials such as old oil tanks, furnaces, water heaters, office cabinets, etc. In these cases municipalities would simply provide a total scrap metal number or an estimate of the percentage of scrap tonnage that was comprised of white goods.

Only the communities of Banff, Alberta; Municipal District of Peace, Alberta; and St. John's, Newfoundland kept exact counts of each type of appliance recovered. North Battleford Saskatchewan was able to provide total number of appliances managed, but not by category. All other programs provided data using weight or alternatively, a combination of weight plus refrigerators/freezers.

To facilitate meaningful comparison and analysis of data, it was necessary to convert information provided into a standard unit of measurement, kilograms.

7.5 Notes on Normalized Kilograms

Calculating a kilogram figure for each program was done by taking reported municipal information (I.e. number of units, tonnes, percentage of scrap) and presenting it in a column entitled "normalized kilograms".

Where a municipality provided actual or estimated weight of white goods processed, that information was used directly (conversion from pounds to kilograms when necessary).

If a municipality provided figures for the total scrap metal collected, unless otherwise specified, it was assumed that white goods constituted fifty percent of that figure. Assumptions on composition per tonne are shown in Table 7.4 for white goods containing ODS, white goods without ODS and for a mix of all appliances. At about 75 kilograms each, one tonne of scrap white goods would contain approximately 13 units of one type or another. Where a municipality provided number of units recovered, the data was converted to kilograms using information on generation and composition outlined in section 5.

If a municipality included totals for CFC containing appliances, an average was used for top or bottom mount refrigerators, side-by-side refrigerators and freezers weighted by their relative average shipments and weights

From this “normalized kilograms” figure the average amount processed by inhabitant for each municipality was deduced by dividing the weight recovered by the municipal population.

TABLE 7.4 2002 Composition per tonne

	Shipment weighted composition of ODS units	Shipment weighted composition of non-ODS Units	Shipment weighted composition of all appliances
Material	**kg per tonne of ODS units disposed**	**kg per tonne of non-ODS units disposed**	**kg per tonne of all appliances disposed**
Steel	581.40	666.35	635.97
Iron	54.57	20.10	32.43
Sub-total: Ferrous metal	**635.97**	**686.44**	**668.39**
Aluminum	20.24	46.32	36.99
Copper	38.16	29.83	32.81
Brass	1.64	1.10	1.29
Other Metal	2.43	13.81	9.74
Sub total: Non-ferrous metal	**62.47**	**91.06**	**80.84**
Rubber	2.02	9.38	6.75
Fiber & Paper	0.89	0.82	0.85
Polypropylene	4.35	93.26	61.47
PS&HIPS	60.89	3.26	23.87
ABS	43.03	0.76	15.88
PVC	11.45	6.43	8.22
Polyurethane	91.37	0.00	32.67
Other plastics	38.61	3.05	15.77
Asst. mixed plastics	16.05	15.24	15.53
Sub total: Plastic	**265.74**	**122.00**	**173.41**
Fiberglass	1.36	35.44	23.25
Glass	26.83	30.06	28.90
Sub total: Glass	**28.19**	**65.50**	**52.16**
Refrigerant	1.70	0.00	0.61
Oil	1.88	2.16	2.06
Other materials typically removed before processing	0.00	0.00	0.00
Sub total: Materials typically removed before processing	**3.58**	**2.16**	**2.67**
Other	**1.14**	**22.63**	**14.95**
Total	**1000.00**	**1000.00**	**1000.00**

Appliance Content Information Courtesy of the Association of Home Appliance Manufacturers
Appliance Lifespan Information Courtesy of APPLIANCE Magazine
Appliance Shipment Information Courtesy of the Canadian Appliance Manufacturers Association, Electro-Federation Canada

Table 7.4 indicates the material composition for one tonne of ODS containing white goods, one tonne of non-ODS containing units and for one tonne of typical mixed appliances.

As shown in table 7.5, the national weighted average of white goods recovered by reporting communities was about 2.03 kilograms per capita for a total of 29,014 metric tonnes.

TABLE 7.5 Normalized kilograms by Province for Reporting Programs Tracking Recovery Quantities

Province	Number of programs tracking quantities	Population of reporting communities with White Goods programs	Normalized kgs	kgs per capita
British Columbia	9	2,755,808	5,245,967	1.90
Alberta	10	1,937,099	3,822,223	1.97
Saskatchewan	3	427,000	1,044,038	2.45
Manitoba	3	691,242	267,020	.39
Ontario	18	5,106,389	13,502,466	2.64
Quebec	1	1,800,000	60,000	.03
New Brunswick	2	122,800	215,000	1.75
Nova Scotia	6	508,404	2428925	4.78
PEI	1	130,000	840,000	6.46
Newfoundland	3	133,039	165,462	1.24
Canada	**56**	**13,611,781**	**29,014,802**	**2.03**

Compared to the estimated waste generation rate of 7.1 kg per capita per yr., municipal programs in most provinces are diverting between 25 and 30 percent of available white goods.

The exceptions would be in Manitoba and Quebec where reported recovery appears well under the national average. In Manitoba this is attributable to the low recovery reported by the City of Winnipeg (2,648 appliances or 192,859 normalized kilograms). Winnipeg accounts for about 96 percent of the population of reporting communities in that province and as a result, skews Manitoba's per capita recovery rate down.

Follow-up with the City of Winnipeg determined that the city only recovers white goods containing ozone-depleting substances. Residents must arrange for same-week pick-up. A $10 fee applies. Alternatively they can drop the old appliance off at the landfill for a lesser fee of $4. All other white goods are placed at the curb for pick-up with regular garbage and are landfilled. It is estimated that up to one half of the units placed at the curb are collected by private entrepreneurs for parts, reconditioning or scrap metal value. Manitoba

Hydro is presently considering a program similar to the one in British Columbia where residents are encouraged to retire second refrigerators through an incentive payment.

In the Province of Quebec both the survey response rate and calculated recovery rate were low. The City of Montreal did provide some recovery data, but noted that it was not representative of all six administrative areas responsible for white goods within the city. For this reason it is not considered to provide an accurate picture of white goods diversion in that city or province.

Another example of how a large city can skew the provincial recovery tonnage is the City of Ottawa. As with London, Ontario, Ottawa does not provide white goods collection for its residents. Instead, the City directs residents to retailers that participate in the City's 'Take it Back' program.[17]

A common problem in both tonnage and cost reporting is the fact that many large cities, regional and county governments, have responsibility for some, but not all, of the white goods programs within their boundaries. This was evident within the Greater Vancouver Regional District, the City of Toronto, and the City of Montreal among others.

TABLE 7.6 Normalized kilograms by Province for all Reporting Programs

Province	Number of programs tracking quantities	Population of all reporting communities	Normalized kgs	kgs per capita
British Columbia	11	2,889,808	5,245,967	1.82
Alberta	12	1,950,965	3,822,223	1.96
Saskatchewan	5	447,200	1,044,038	2.33
Manitoba	4	700,994	267020	0.38
Ontario	24	5,341,352	14,682,166	2.75
Quebec	3	2,291,000	60,000	.03
New Brunswick	2	122,800	215,000	1.75
Nova Scotia	9	537,528	3,428,926	6.38
Prince Edward Island	1	130,039	84,000	0.65
Newfoundland	3	133,039	165,462	1.24
Canada	**74**	**14,544,725**	**29,014,802**	**1.99**

An amalgamated municipal government structure in which the provision of waste services remains with former communities is one reason for this decentralized approach. Another factor is the existence of historic contractual arrangements

[17] Ottawa Take It Back Program for White Goods, http://ottawa.ca/gc/takeitback/hh_appliances_en.shtml

with different companies in different geographic areas within the larger community. The net result is that data is often not centralized or available to senior administrators in a standard format. As a result, the tonnage and cost submissions for these larger communities is generally considered incomplete. This would explain the comparatively low kilogram-per-capita performance of the larger municipalities that responded to the survey.

About 8 of 74 municipal programs across the country reported an annual recovery rate that actually exceeded the estimated 7.1 kg. per capita generation rate of obsolete white goods. In these cases, follow-up determined that recovery was overstated because total scrap numbers were being used. Municipal mixed scrap metal programs sometimes include derelict automobile hulks thereby skewing reported white goods recovery. Adjustments downward were subsequently made after consultation with these programs.

Determining the relative effectiveness of curbside versus depot collection is not simple because a high percentage of programs that offer curbside collection also provide depot service. With the exception of the Region of Peel in Ontario, no municipalities tracked their curbside and depot recovery separately. The Region of Peel reported that recovery of white goods was about 15 times higher through their curbside program than their depot program.

Interestingly communities that relied on drop off depots tended to have higher rates of recovery than larger centres with curbside collection options. This may partly be accounted for by incomplete reporting from larger municipalities. It may also reflect lack of an alternative private-sector infrastructure.

7.6 Estimating National White Goods Diversion from Municipal Programs

It should be stressed that, because municipal white goods diversion numbers are so often hidden within larger scrap metal diversion numbers and because 27 percent of reporting municipalities were unable to provide any recovery estimates, overall diversion estimates in this report should be considered ball park only.

Estimating national recovery of white goods based on the sample of communities that responded to the survey requires a determination about how representative the 48 percent (by population) of reporting communities are compared to the 52 percent of non-reporting communities.

It can safely be assumed that, because 19 of 20 of the country's largest municipalities are covered within the reporting group, those not reporting are smaller and more remote. In fact, with the exception of a handful of communities with populations between 100,000 and 150,000, all non-reporting communities have populations fewer than 100,000.

These communities are more likely to be located at a greater distance from major industrial centres. Therefore, the cost of transportation associated with marketing collected white goods will be less favourable. As well, smaller municipalities, particularly in Western Canada, are far more likely to rely on drop-off depots than on curbside collection.

However, a comparison of different sized communities (see Table 7.7) would indicate that recovery rates are sometimes higher in smaller centres than larger ones.

TABLE 7.7 Recovery per Capita by Size of Population (reporting communities with white goods programs only)

Populations of reporting communities	Normalized kilograms	kilograms per capita
< 50,000	1,856,723	4.22
50,000 – 100,000	4,202,795	4.69
100,000-500,000	11,285,588	2.98
>500,000	11,669,696	1.35

This can be explained by the fact that small municipalities may receive a higher percentage of the white goods generated in a community due to the absence of a strong retail take-back network or well-developed local sector scrap metal market. As well, travel distance to a drop-off point may be more convenient for the public in a smaller community than a large one resulting in stronger depot performance.

Finally, in extrapolating survey results to all communities, the likelihood that some non-respondents did not participate in the survey because they do not have white goods recovery programs should be considered.

For these reasons national recovery of white goods through municipal programs is estimated in the following three ways.

A) Assumption that white goods recovery in reporting municipal programs is representative of all Canadian municipalities.

B) Assumption that white goods recovery in non-reporting municipal programs is consistent with the average per capita recovery in communities with population of 100,000 or less

C) Assumption that white goods recovery in non-reporting communities is half as effective as in reporting communities with a population of 100,000 or less.

TABLE 7.8 Calculation of National Municipal White Goods Recovery

	Description	Calculation	National recovery (kg)
A	Average recovery of 1.99 kg per capita multiplied by national population of 29,522,305 (2001 census)	1.99 X 29,522,305	58,749,387
B	Normalized kgs. of reporting communities + population of non-reporting communities (14,977,580) multiplied by weighted average of normalized kilograms for all reporting communities of population <100,000 (3.45 kg/capita)	29,014,802 + (14,977,580 X 3.45)	80,687,453
C	Normalized kgs. of reporting communities + Population of non-reporting communities (14,977,580) multiplied by 50% of the weighted average of normalized kilograms for all reporting communities of populaton <100,000 (1.725 kg/capita)	29,014,802 + (14,977,580 X 1.725)	54,851,127

7.7 Municipal Program Economics

The municipal survey indicates that a significant proportion of municipalities do not have a clear picture of the revenues and costs associated with their white goods recovery programs. This is due to a combination of factors including:

- ✧ Poor understanding of quantities managed;
- ✧ Costs are hidden in other administrative, operational and promotional budgets;
- ✧ Range of program types (E.g. curbside, depot, special days);
- ✧ Multiple white goods contracts with different contractors responsible for different service areas within a jurisdiction;
- ✧ No rationale for detailed tracking;
- ✧ Revenues are hidden in total scrap metal revenues; and,
- ✧ Lack of a generally accepted waste management accounting practice.

Many municipalities commented that there is currently no need for them to expend resources detailing the breakdown of scrap metals handled. When dealing with contractors and end markets, municipal waste management officials are concerned more with total scrap volume and tonnage than with composition.

Of the 74 programs that participated in the survey only 22 were able to provide both revenue and cost estimates. Of these, 11 showed a net cost for their programs, 9 calculated a net surplus and one was revenue neutral.

13 other programs reported revenue only while 14 reported costs only. A second community indicated that its program is revenue neutral but did not provide data.

Interestingly, both revenues and costs varied widely, even among communities of similar population and geographic proximity. Of communities that reported both costs and revenues, the national weighted net average program cost was $37.68/tonne.

Because of the potential for both costs and revenues to be hidden in other municipal waste budget items, financial data presented here is not conclusive and should be considered representative only.

Because many calculations of municipal costs have been conducted without an opportunity for verification with the affected parties, municipalities are not identified by name.

7.7.1 Municipal Program Revenues

There are generally two sources of revenue for municipal white goods recovery programs:

- ✧ Disposal/recycling charges (tipping fees) to the householder/generator for collection or drop-off; and,
- ✧ Receipts from the sale of materials to scrap metal companies.

However, revenue was reported in a variety of formats including:

- ✧ Value per tonne of scrap metal if picked up;
- ✧ Value per tonne of scrap metal if delivered;
- ✧ Range of values per tonne depending on market conditions;
- ✧ Tipping fee charged per unit;
- ✧ Total received from all sources per unit;
- ✧ Total combined revenues from all sources;
- ✧ Amount per unit received as revenue share with contractor; and,
- ✧ Combination of the above.

In a number of cases municipalities simply contract with a service provider to manage their white goods program and so do not see the revenues, which accrue to the contractor. In many jurisdictions white goods recycling is market driven.

TABLE 7.9 Municipal White Goods Revenue (all reporting programs)

Municipality	Population	Normalized tonnes	Revenue per tonne ($)	Revenue ($)	Weighted revenue per tonne all programs
A	101936	110	2	200	
B	85000	795	10	7,952	
C	44000	375	10	3,750	
D	636000	193	10	2,000	
E	38625	180	12	2,131	
F	220000	294	12	3,500	
G	310000	2500	12	30,000	
H	21000	73	12	870	
I	51,000	731	13	9,244	
J	14,421	101	16	1,667	
K	490,268	577	19	11,070	
L	351,000	500	20	10,000	
M	105,000	61	23	1,373	
N	9,358	39	25	985	
O	120,000	205	27	5,500	
P	70,000	806	31	25,000	
Q	922,000	2,779	47	130,000	
R	1,986,965	2,227	50	111,346	
S	469,800	3,094	53	164,646	
T	205,000	558	54	30,000	
U	10,000	91	55	4,960	
V	11,000	15	67	1,000	
W	14,000	103	73	7,500	
X	15,000	25	78	1,950	
Y	937,845	800	88	70,000	
Z	75,000	541	92	50,000	
AA	192,000	725	115	83,288	
AB	231,300	315	116	36,572	
AC	830,000	96	117	11,230	
AD	42,242	63	159	10,000	
AE	7,200	6	234	1,390	
AF	500,000	41	317	13,000	
AG	106,000	73	401	29,295	
All programs	**8,681,660**	**19,091**		**$871,418**	**$45.65**

**Note: 37 programs provided revenue information, however, due to the nature of the reporting, calculations were only possible for 34 programs*

Tipping fees are a common feature of white goods programs. The amount charged per appliance varies from $5 to $10 for units that do not contain ozone-

depleting substances. For refrigerators and freezers (and air conditioners), the fee charged is usually $20. The higher fee is intended to offset contractor costs for the purging and recovery of ODS from these types of units.

For comparative purposes revenues are expressed per tonne. Gross revenue figures provided by all programs varied from $1.80 up to $401.30 per tonne. The weighted national average of all revenue figures provided was $45.65.

7.7.2 Municipal Program Expenses

Just as revenues are often hidden within larger scrap metal revenue figures, costs for white goods recovery are often hidden within other budgets.

In the municipal survey, municipalities were asked to break out where possible the costs of:

- ✧ Promotion;
- ✧ Coordination;
- ✧ Staffing;
- ✧ Contractors;
- ✧ Transportation; and
- ✧ Total combined costs.

Ten municipalities provided promotional costs, and eight provided staff coordination costs. Three provided special event staffing costs, 12 provided contractor fees, two provided transportation costs and 13 provided total combined costs.

As with program revenues, there is a significant spread between the lowest and highest reported costs. For example, three communities report costs per tonne of less than $10. At the same time the highest cost program in the country worked out to $1,278 per tonne. In that community, white goods are estimated as one half by weight of the community's annual bulky goods collection for which they pay a fixed price of $40,000. Table 7.10 summarizes the costs submitted by reporting municipalities.

TABLE 7.10 Municipal White Goods Costs (all reporting programs)

Municipality	Population	Normalized tonnes	Cost per tonne ($)	Cost ($)	Weighted cost per tonne for all programs
A	350,000	1,225	1	1,000	
B	85,000	795	4	3,400	
C	125,000	230	4	1,000	
D	830,000	96	21	2,000	
E	105,000	61	23	1,373	
F	922,000	2,779	23	65,000	
G	44,000	375	32	12,000	
H	11,000	15	33	500	
I	31,843	265	35	9,317	
J	75,000	541	37	20,000	
K	106,000	73	44	3,200	
L	14,000	103	49	5,000	
M	58,000	200	50	10,000	
N	15,630	45	56	2,500	
O	192,000	725	69	50,000	
P	14,421	101	73	7,434	
Q	10,000	91	77	7,000	
R	10,400	58	86	5,000	
S	205,000	558	90	50,000	
T	310000	2,500	95	238,000	
U	15,700	20	103	2,000	
V	351,000	500	105	52,720	
W	937,845	800	118	94,000	
X	409,800	897	120	107,640	
Y	130,000	84	143	12,000	
Z	7,200	6	146	870	
AA	1,054,000	2,796	199	556,000	
AB	231300	315	221	69,672	
AC	636,000	193	259	50,000	
AD	490,268	577	267	153,958	
AE	2,800	10	300	3,000	
AF	101,936	110	574	63,385	
AG	70,000	31	1,278	40,000	
All Programs	**7,410,843**	**17,174**		**$1,698,969**	**$98.93**

**Note: Municipalities A,B,C etc. do not correspond to the municipalities of the same name in Table 7.9*

7.7.3 Municipal Net Revenue/Expenses

Of 22 programs that reported both revenue and expenses, 11 were determined to operate at a net cost while nine showed a revenue surplus.

Table 7.11 once again shows the considerable variance in operating costs between programs, from a net cost of $572/tonne to a net revenue of $357/tonne. This is accounted for by a range of factors including:

- ✧ Different accounting procedures;
- ✧ Different contractual arrangements;
- ✧ Different program types and cost structures;
- ✧ And different market conditions.

TABLE 7.11 Municipal White Goods Net Revenue/Costs

Municipality	Population	Normalized tonnes	Revenue per tonne	Cost per tonne	Net revenue/ cost	Net revenue / cost / tonne
A	101,936	110	1.81	573.82	(63,185.00)	-572.01
B	636,000	193	10.37	259.26	(48,000.00)	-248.89
C	490,268	577	19.19	266.82	(142,888.00)	-247.64
D	231300	315	116.25	221.47	(33,100.25)	-105.22
E	351,000	500	20.00	105.44	(42,720.00)	-85.44
F	310,000	2,500	12.00	95.20	(208,000.00)	-83.20
G	14,421	101	16.43	73.28	(5,767.18)	-56.85
H	205,000	558	53.76	89.61	(20,000.00)	-35.84
I	937,845	800	87.50	117.51	(24,000.00)	-30.00
J	10,000	91	54.69	77.19	(2,040.00)	-22.49
K	44,000	375	10.00	32.00	(8,250.00)	-22.00
L	105,000	61	22.50	22.50	-	0.00
M	85,000	795	10.00	4.28	4,552.00	5.72
N	922,000	2,779	46.78	23.39	65,000.00	23.39
O	14,000	103	72.82	48.54	2,500.00	24.27
P	11,000	15	66.67	33.33	500.00	33.33
Q	192,000	725	114.88	68.97	33,288.00	45.91
R	75,000	541	92.50	37.00	30,000.00	55.50
S	7,200	6	233.79	146.33	520.00	87.46
T	830,000	96	117.49	20.92	9,230.00	96.57
U	106,000	73	401.30	43.84	26,095.00	357.47
V	**5,447,670**	**11,313**			**(426,265.43)**	**-37.67**

A full analysis of each program's accounting systems is beyond the scope of this study.

The weighted average cost for all municipalities that reported both revenues and expenses is $37.67/tonne.

Program costs can also be calculated on a per capita basis by dividing the net cost of reporting programs ($426,265) by the populations in those communities (5,447,670). Using this method, the net per capita cost of white goods programs in communities representing about 18 percent of the national population, is 7.82 cents. That translates into about 20 cents per household.

Applied nationally to all communities and households, the net annual cost of municipal white goods management would be approximately $2.3 million.

8. Multi-Unit Building Recovery Programs

The 2001 Canadian Census indicates that 9 percent of Canadians live in multi-unit apartment buildings consisting of five units or greater (1,050,195 units), while 90 percent live in single detached homes or other dwellings such as townhouses (10,355,220 units)[18]

TABLE 8.1 Number and Type of Dwellings by Province

	Number of units		Percentage split	
	Single-detached + other	**Multi-unit**	**Detached + other**	**Multi-unit**
BC	1,388,855	101,570	93%	7%
AB	1,018,095	49,475	95%	5%
SK	362,065	10,715	97%	3%
MB	387,330	37,625	89%	11%
ON	3,258,715	678,325	79%	21%
PQ	2,802,530	154,220	95%	5%
NB	270,725	3,525	99%	1%
NS	333,315	13,370	96%	4%
PEI	48,545	30	99%	<1%
NF	186745	945	99%	1%
Canada	**10,326,920**	**1,049,800**	**91%**	**9%**

Source: Statistics Canada, Private households by structural type of dwelling, provinces and territories, 2001 Census

To obtain a better understanding of white goods disposal in this sector, interviews were conducted with Canada's largest residential property management firms and several of the associations representing them.

Those interviewed were queried about:

- ✧ The number of units managed;
- ✧ Policies and practices for purchase and disposal of appliances;
- ✧ Quantities of appliances disposed of per year; and,
- ✧ Specific reuse, recycling and disposal channels.

Property management firms manage three distinct types of property: condominiums, private apartments and public housing. White goods disposal policies tend to be different for condominiums than they are for private apartments and public housing.

[18] Statistics Canada, Private Households by Structural Type and Dwelling, 2001 Census, http://www.statcan.ca/english/Pgdb/famil55a.htm

All the condominium managers interviewed indicated that condominium owners are responsible for their own appliance disposal and personally arrange for pick-up and disposal. Retail take-back programs appear to be the preferred option, but local contractors/scrap haulers pick-up old appliances as well. All of those interviewed agreed that virtually no end-of-life appliances enter the municipal waste stream from condominiums.

Private apartments and public housing tend to have very different policies and practices. Property managers indicated that appliances in rental units tend to have shorter life spans than appliances that are privately owned. To extend the life span of appliances as much as possible property managers cycle appliances from higher-end units to lower end units as they age. They tend to be repaired when possible using parts stripped from non-functioning units. What happens to a non-repairable appliance that needs to be disposed of tends to vary from building to building. Superintendents often have relationships with repair stores, resellers or scrap haulers that will purchase or collect for free non-functioning appliances. Revenues derived from the sale of non-functioning appliances range from $5 to $10 each. Municipalities may have pick-up arrangements with a small number of buildings (estimated at less than 10 percent), but often appliances put out for municipal disposal are scavenged from the curbside before the municipal trucks arrive.

Most property management companies also purchase appliances in bulk. They purchase from many sources, but the largest supplier of new appliances to property managers in Canada is Appliance Canada. Appliance Canada takes away non-functioning units for their clients as well as all the packaging from new appliances when making deliveries.

Appliance Canada was contacted to determine how they manage the units they take back. A variety of means are used depending on local conditions including: sale to scrap companies, repair shops and resellers, and drop-off at municipal landfills. Appliance Canada was not able to provide any information on the quantity of these appliances that would enter the municipal waste stream.

Only one property management company provided information on the quantities of white goods disposed of annually. ResREIT manages almost 11,000 apartments across Canada and disposes of approximately 650 appliances a year. If this number is representative of other property managers, it can be assumed that multi-unit residences would generate approximately 62,057 appliances in a given year. Based on our interview findings we would also expect that less than 10 percent (<6,206) would end up in the municipal waste stream.

9. Retail Recovery Programs

The national surveys of white goods take-back programs by major and independent retailers across Canada revealed a mature and effective recovery infrastructure.

The majority of retailers have policies in place to remove an old appliance from a customer's premises, when a new one is delivered. However, polices within companies do vary from region to region across Canada depending on, independent franchisee decisions, contracts with third party delivery companies, and access to used appliance purchasers or scrap metal companies. Some companies charge a fee for the service while others do not.

Competitive market conditions also affect regional take-back policies. For example, free delivery and appliance take-away is more of a competitive issue between major retailers in Quebec than in other parts of the country. For this reason, most major retailers provide free take-away in Quebec though they may charge in other parts of the country. At least one retailer offers appliance take back across the country, except in Atlantic Canada.

As with municipalities, retailers, whether large or small, were unable to provide accurate records of the number of obsolete units recovered. Instead they would express recovery as an estimated percentage of new units sold. In some cases, head office officials simply had no idea of the delivery and take back policies of their independent dealers or franchisees across the country.

Unlike municipalities that tend to deal with a single contractor or end market for final disposition of the white goods they collect, large retailers, particularly in urban areas, tend to deal with a number of buyers in order to secure the best price per lot. The price they receive per unit varies according to market conditions but would appear to be between $5 and $10 each.

Once sold, old units are then either stripped for reusable parts (motors, compressors, etc.), reconditioned for resale in the second-hand market, or simply sold as scrap metal.

Based on anecdotal information, it would appear that roughly 10 percent of units recovered by retailers are partially or wholly reused. More detailed study of the second-hand appliance reseller and broker sectors is required to corroborate this information.

9.1 Major Retailer Programs

10 Major retailers representing over 3,655 outlets were surveyed. These large companies all boast sales over $500 million per year. According to 2002 sales

data from North American market research firm, Trendex,[19] these companies together accounted for 61.6 percent of retail appliance sales in Canada in that year.

Companies surveyed included:

- ✧ Sears Canada Inc
- ✧ The Bay/Zellers (HBC)
- ✧ Wal-Mart
- ✧ Corbeil Electromenagers
- ✧ Tanguay/Brault Martineau (BMTC Group)
- ✧ The Brick Warehouse Corporation
- ✧ Leons Furniture Limited
- ✧ Future Shop/Best Buy
- ✧ Home Depot Canada
- ✧ Price Club/Costco

Only one company failed to respond to repeated requests. Another company declined to participate, however, detailed information on its appliance take-back program was available through its independent outlets and web site and has been incorporated in the report.

Two major retailers representing about 7 percent of the market do not take back old appliances from their customers although they do remove the packaging and will assist householders in relocating the old unit within the home, or to the curbside for municipal pick-up.

Major retailers generally charge service fees to cover the cost of old appliance removal. This fee varies between $10 and $100 but may be bundled with other services including delivery charge, appliance hook-up and preparation. For example, Sears, the largest appliance retailer in Canada, has a three tier – Gold, silver, Bronze – program[20]. Only the Gold level service qualifies for old-appliance removal except in the Province of Quebec where both Gold and Silver service levels qualify. As with most major retailers, uniform policies do not apply to rural and remote areas where delivery and take-away services (if available) are established according to local conditions. This is one explanation as to why the municipal role in collection of white goods is greater in smaller and outlying communities.

In Quebec, Corbeil Electromenagers[21] and Tanguay/Brault Martineau (BMTC Group)[22] are the largest regional appliance retailers. Both provide free pick up of old white goods.

[19] Trendex Quarterly Canadian Household Equipment Study, http://www.trendexna.com/household_equipment_study.htm
[20] Sears Shipping & Returns Policy, www.sears.ca/e/customerservice/shipping.htm
[21] Corebeil Electromenagers/Appliances, Delivery Policy, www.corbeilelectro.com/english/delivery.html

Table 9.1 provides an overview of take-back policies by major retailers in Canada.

TABLE 9.1 Major Retailer Take-Back Policies

Major retailer	Province	Stores	Appliance take back
Leons Furniture Limited	AB,SK,MB,ON, PQ,NB,NS,PEI,NF	54	Yes, limited to certain markets only
Costco Wholesale	Every Province except NWT, PEI	63	Yes, $10 fee applies
HBC	Every Province except PEI, NF, 3 Territories	100	No
Sears Canada Inc	Every Province & Territory	2100+	Yes, $100 fee applies, $50 in PQ. No take back in Atlantic Provinces
The Brick Warehouse Corporation	BC,AB,SK,MB,ON	78	Yes, $50 fee applies.
Home Hardware Stores Limited	Every Province except NWT	1000+	Varies by Region/Dealer
Home Depot	BC,AB,SK,MB,ON,PQ,	103	Yes, $10 fee applies
Best Buy/Future Shop	129	120+	Up to delivery company
Corbeil Electromenagers	PQ	25	Yes, no charge
Tanguay/Brault et Martineau	PQ	13	Yes, no charge

Table 9.2 shows the approximate calculation of white goods recovered nationally by major retailers. Net market recovery figures were derived by multiplying the individual take-back rates reported (percentage of units delivered) by each company's estimated market share. This figure was then multiplied by the total number of obsolete units entering the waste stream in 2002 and by the estimated average weight per unit to establish total weight of materials recovered.

Where a company reported taking back 100 percent, this figure was reduced to 90 percent to allow for customer pick-up associated with cash and carry sales and for customers who do not have old units to retire.

Companies that were unable to estimate recovery for whatever reason (e.g. did not participate in survey, lack of regional data, third party collection, etc.), were calculated as 0 percent take back.

[22] Brault Martineau Appliance Delivery Policy, www.braultmartineau.com/MBM/NsLivraisons.aspx

Names of retailers are not shown in order to protect market share information. Similarly, some retail figures were combined to further disguise market share numbers due to the dominant market position of one company.

Based on these calculations it is estimated that major retailers diverted approximately 420,300 units of white goods in 2002 with a combined weight of approximately 31,422 tonnes.

TABLE 9.2 Calculation of 2002 Recovery of White Goods by Major Retailers

	Estimated 2002 market share (%)	Estimated take back per units delivered (%)	Net recovery (market share X take back)	2002 units entering waste stream	Units recovered	Weight per unit recovered (kg.)	Total weight recovered (tonnes)
Retailers A+B+C	45.7	5%, 25% & 3%	8%				
Retailer D	4.5	5%	0%				
Retailer E	2.6	90%	2%				
Retailer F	2.4	0%	0%				
Retailer G	2.3	90%	2%				
Retailer H	1.7	90%	2%				
Retailer I	1.4	90%	1%				
Retailer J	.6	0%	0%				
Retailer K	.4	0%	0%				
	0						
Total	**0.616**		**15%**	**2,802,000**	**420,300**	**74.76**	**31,422**

**Note: 11 Companies represented because HBC is shown as two companies, Zellers and The Bay.*

9.2 Independent Retailer Programs

32 independent retailers were surveyed by telephone to determine their programs and policies on old appliance take-back and packaging management. 28 municipalities in British Columbia, Alberta, Manitoba, Ontario and Quebec participated in the survey.

Because of its significant position in the Quebec marketplace, results for 25 stores in the Corbeil Electromenagers chain, are included in the preceding major retailer category.

Independent retailers represent approximately 20 percent of the retail appliance sales market in Canada. Companies that responded to the survey represent 77 stores.

The survey lists, which were compiled from Yellow Pages advertising, are not considered comprehensive and do not cover the Province of Saskatchewan or

the Atlantic Provinces. For this reason, survey results and conclusions provide a characterization of the sector but may not be totally authoritative.

TABLE 9.3 Description of White Goods Recovery by Independent Retailers

Retailer	Prov	Stores	Appliance take back	Service fee charged	
AMG Appliances	ON	1	No		
Shuh Appliances	ON	1	90%		
Smith Vernon Furniture & Appliances	ON	1	90%		
Domaine	ON	1	No		
Allen's Furniture Warehouse	ON	1	No		
Blacks FW Ltd.	ON	1	90%		
Shaw's Furniture & Appliances	ON	1	90%		
Metro Karges Appliances	ON	1	*50%		
TA Appliance Warehouse	ON	1	90%		
Tepperman's Furniture Appliance	ON	6	*50%	Yes, multi-tier service program	
Colonial Furniture	ON	4	90%		
Abrams Leo P & Son Inc	ON	1	90%		
Bad Boy	ON	5	*50%	$5	
Bains Appliance Parts and Service	MB	1	*50%		
Dufresne Furniture & Appliances	MB	2	*50%		
Kern-Hill Furniture Co-op Ltd.	MB	1	50%		
Atlas Appliances	AB	1	90%		
Bestway Television and Appliances	AB	1	*50%		
Trail Appliances	AB, BC	11	90%		
Best Appliance Centre	AB	1	*50%	$10	
Bi-Rite Furniture Warehouse	BC	2	90%		
City Furniture (Pg) Ltd	BC	1	*50%		
Northern Hardware and Furniture Co	BC	2	90%		
R K Furniture Gallery	BC	1	No		
Ben's Direct Maytag Home Appliance Center	BC	1	90%		
Westcoast Appliance	BC	1	90%		
Stockli Maytag Home Appliance Centre	BC	1	90%		

** Note: In absence of estimated take-back percentages, 50 percent is assumed.*

With that provision, it is interesting to note that independent retailers overwhelmingly report having policies and programs to recover old appliances from customers when new ones are delivered. Most do not charge a fee believing it is a service that provides a competitive advantage over major retailers.

Only four companies responded that they did not take-back old appliances. Only three companies reported charging for take-back service – either $5 or $10 per unit.

All but three independent retailers report taking back 100 percent of old appliances when new ones are delivered. As with major retailer calculations, recovery by independent retailers has been revised down by 10 percent to allow for cash and carry purchases and for purchasers without old units to retire.

Calculation of national recovery is similar to the calculation performed to determine major retail recovery. In the absence of market share data, number of stores is used as a weighting factor. Where a company did not provide an estimate of percentage recovered, 50 percent is assumed.

Table 9.4 summarizes information from Table 9.3 by multiplying stores by their estimated recovery rates to determine an overall sector diversion percentage. This number is then applied to the total estimated white goods generation in Canada for 2002 (209,487 tonnes).

According to these calculations, if representative of all independent appliance retailers in the country, total recovery is estimated to be approximately 28,490 tonnes or 13.6 percent of all white goods thought to be entering the municipal waste stream in 2002.

TABLE 9.4 Calculation of Estimated Recovery by Independent Retailers

A	B	C	D	E	F	G
Estimated recovery rate	**Number of locations**	**Recovery factor (A X B)**	**Aggregate recovery rate (C÷B)**	**Independent market share (est)**	**Net recovery rate (D X E)**	**Net recovery (tonnes) 209,487 tonnes X 13.6%**
90%	29	26.1	68%	20%	13.6%	28,490
50%	19	9.5				
0%	4	0				
Total	**52**	**35.6**				

10. Other White Goods Recovery Programs

10.1 Appliance Resellers

Appliance resellers deal directly with apartment buildings, retailers, scrap metal brokers and occasionally municipalities to source resalable used appliances. Often buying in bulk, these companies will then sort and sell off unusable white goods for scrap metal recycling. Some companies also deal in the recovery and resale of used parts for the white goods repair market. The resellers are a key group in quantifying relative flows (to reuse or recycling) of white goods unaccounted for by municipal or retail-take back programs.

An interesting query raised during this study is: To what extent do second hand appliance retailers extend the life span of appliances and how much do they divert from the municipal waste stream?

The second hand appliance sector in Canada is comprised entirely of independent stores and no association exists that has any collective data on this market sector. Using the Internet and Yellow Pages listings a database of 232 used appliance resellers was compiled.

To better understand this market sector a telephone survey was developed. 20 retailers were contacted and seven participated in interviews. The retailers that have been surveyed are located in:

- ✧ Victoria and Burnaby, British Columbia;
- ✧ Edmonton, Alberta;
- ✧ Saskatoon, Saskatchewan;
- ✧ Winnipeg, Manitoba; as well as,
- ✧ Hamilton and Toronto, Ontario.

Survey questions probed issues related to the supply of used appliances in terms of types, quantities and sources, as well as the market for used appliances and disposal of non-functioning units.

The results suggest that each reseller operates in their own unique ways and that few commonalities exist between resellers.

All the resellers interviewed, with the exception of one (in business since last April), have been in business for more than seven years. They note that the market for used-appliances is highly competitive and that profit margins are small. This is a function of the amount consumers are willing to pay for a used appliance combined with the high cost of parts and the time required to refurbish a used appliance. A retailer from Victoria notes that the supply and market for used appliances in that city is “locked up” by five 5 retailers. As a result, it is very difficult for new players to that market.

The area in which the most commonalities can be found is sales. All individuals interviewed note that there is high demand for white or stainless steel appliances and very little demand for almond or any other coloured appliance. Most said that the demand for different types of appliances is relatively equal with the exception of a Toronto retailer, who sells mostly to small apartment buildings, where demand is primarily for fridges and stoves.

When asked about sales volumes, all retailers remarked that sales fluctuate depending on the time of year and the supply of used appliances. But on average, sales are in the range of 40 to 60 used appliances per month.

The age of used appliances sold generally ranges from two to 20 years, with the exception of Victoria where the reseller interviewed also serves a niche market for “retro” fridges. That reseller often obtains fridges as old as 55 years.

When asked about the most major sources of used appliances each reseller highlighted a different type of source. Who the retailer obtains used appliances from seems to be dependent upon their clients as well as relationships that have been developed to ensure a steady supply. In Toronto, for example, the retailer cites property managers and peddlers as major sources of used appliances. In Saskatchewan, where the reseller also delivers new appliances for some of major appliance retailers, most used-appliances originate from retail take-back programs. In Winnipeg, the reseller scavenges for appliances or purchases from peddlers. The reseller in Victoria obtains all his appliances through advertising. For the Hamilton reseller, the municipality and new homeowners are the major sources of appliances.

All of the retailers interviewed note that they strip non-repairable units for parts (for resale) and either sell or give the remainder to scrap metal firms.

For the purposes of estimating reseller diversion it is estimated that reseller recovered approximately10% of all the obsolete white goods not presently being managed through retail or municipal programs. This represents between 6,470 and 9,054 tonnes of material or as many as 120,000 units annually.

10.2 Scrap Handlers

A survey of Canadian scrap handling companies was undertaken to try and determine the quantities of white goods recovered, the origin of the white goods, market factors influencing the quantity of white goods recovered and their ultimate fate.

In all, 16 of the 126 companies approached participated in the study. Survey responses received, per province are.

- ✧ British Columbia 2

- ✧ Alberta 7
- ✧ Saskatchewan 1
- ✧ Ontario 5
- ✧ Newfoundland 1

None of the scrap handlers participating in the study are end-users. They process and ship white goods to an end-user.

14 companies provided information on the quantities of white goods processed. The total quantity of white goods processed by these companies is approximately 21,000 metric tonnes per year. The quantities processed per year range from less than 10 tonnes per year to 5,000 tonnes per year. Based on the quantities reported, a scrap company might typically process 1,500 metric tonnes per year. It is estimated that surveyed companies process in the range of 189,000 metric tonnes of scrap white goods in any given year.

Not all companies were able to identify the percentage of scrap (by weight) made up of white goods, but of the estimates received, percentages varied from 1% to 80%.

Scrap handlers were asked if they received their supply of white goods from municipal governments, retailers, resellers/contractors, peddlers, residences or others. Most companies identified multiple sources.

The break down of responses is as follows:

Residences	11
Municipalities	7
Peddlers	8
Resellers/contractors	7
Retailers	4

11 companies indicate that they buy scrap white goods from the public; the other five accept white goods for free.

10 of the scrap handlers note that the price of steel does not affect the quantity of white goods they process. Six companies, however, indicate that the price of steel does affect the quantity of white goods they process. Reasons given include:

- ✧ When steel prices are down scrap handlers may not be able to pay for white goods and may have to charge for services, which can result in suppliers stockpiling white goods until the price of steel increases.
- ✧ Price influences the viability to finance (i.e. cost for fuel, human resources etc. do not fluctuate as steel prices do).

Only five of the 16 companies surveyed indicate that they travel to recover white goods. Distances that companies are willing to travel vary from as little as 10 kilometres to one company that will travel anywhere in their province, provided they are picking up at least 80,000 lbs of total scrap.

Scrap handlers also do not seem to have a good sense of the size of the catchment area they service. Several scrap companies did not answer the question. Others just list the name of the municipality in which they are located. Of those providing numbers, some define catchment area in terms of distances such as square miles, or # mile/km radius while others define catchment area in terms of population size. Interestingly, the two companies that define their catchment area in terms of population both identify a catchment area of approximately 100,000 people.

In terms of environmental considerations, six scrap handlers indicate that they remove CFCs from white goods. One scrap handler recovers mercury switches as well. Nine scrap handlers indicate that they do not accept appliances containing CFCs. They will only accept appliances that have been drained and tagged by someone certified to do so. One other scrap handling company states that they do not accept appliances that contain either CFCs or Mercury.

None of the scrap handling companies strip white goods of parts for re-use or re-sale, with the exception of the one company that removes mercury switches.

In terms of the fate of white goods, all of the companies surveyed indicate that the scrap is re-smelted.

Given the small number of surveys that were returned as well as the incomplete nature of the database that was used, it is difficult to draw any solid conclusions from the scrap survey, however, large numbers of small independent scrap metal scavengers are very proactive in recovering white goods that are put out for municipal recycling and disposal collection. It is estimated that these ‘unofficial’ recyclers recover as much as half of municipally generated white goods. This represents between 29,000 and 40,000 tonnes annually.

To obtain more meaningful information it might be useful to undertake a more specific in-depth survey with the help of an industry association such as the Canadian Association of Recycling Industries or the Canadian Steel Producers Association. The involvement of one or both of these industry associations may help to build trust and obtain greater buy-in from scrap handlers.

10.3 Curbside Scavenging

The scavenging by private entrepreneurs of white goods placed at the curb for municipal recycling or disposal collection accounts for a significant percentage of total white goods diversion.

It is estimated that as many as 40,000 tonnes of white goods are “unofficially” collected by a well-developed network of small to medium sized companies, that scour the streets for old appliances in advance of municipal collection crews.

Municipalities were unable to quantify how much material is scavenged but provided anecdotal estimates that half of all units placed at the curb are scavenged.

Private entrepreneurs object to being referred to as scavengers. However, under most municipal bylaws, materials placed at the curb for collection are municipal property. Despite the fact that removal of these units is technically theft, many municipalities accept and even encourage the activity as it reduces municipal collection and disposal costs.

The fact that this private sector collection infrastructure is so well developed supports the fact that white goods recycling is market driven in many jurisdictions.

Table 11.1B (next section) refers to white goods diversion estimates from scavenging activities.

11. Estimated Waste Diversion Flows in Canada

This section quantifies the total estimated material flows associated with white goods recovery programs in Canada. It also identifies the estimated quantity of white goods that are handled through programs other than municipal collection or retail take back including:

- ✧ Municipal disposal
- ✧ Curbside scavenging by independent entrepreneurs
- ✧ Householder sale or donation to scrap metal companies
- ✧ Units reconditioned for resale by retailers or charities
- ✧ Units generated by multi-unit buildings

This section also breaks down the material composition of white goods recovered by the municipal and retail sectors.

As indicated in Table 11.1, according to calculations in Section 7 of this report, municipalities across Canada recovered between 26 and 38 percent of all obsolete white goods generated in 2002. This represents between 54,851 and 80,687 metric tonnes.

Major retailers are attributed with taking back approximately 15 percent of all obsolete white goods or 31,422 tonnes while independent retailers diverted an almost equivalent amount, 14 percent or 28,490 tonnes. Combined, the retail sector diverted 59,912 tonnes or 29 percent of all available end-of-life white goods.

The total diversion attributable to municipal and retail recovery programs, therefore, is estimated to be between 114,763 and 140,599 tonnes. Expressed as a percentage, municipal and retail programs diverted between 55 and 67 percent of end-of-life white goods in 2002.

The balance of white goods that is managed through other means such as curbside scavenging, donation or resale, apartment building recycling and disposal is estimated to be between 68,888 and 94,724 tonnes or 33 to 45 percent of total generation.

It is more difficult to estimate material flows among these ‘other’ systems. However, as referenced in Section 8**,** apartment buildings are thought to manage about 62,000 units weighing roughly 4,650 tonnes. Of this quantity, the bulk is sold to private companies. It is thought that less than 10 percent enter the municipal stream. About 4,185 tonnes are diverted from multi-unit buildings primarily through recycling.

Curbside scavenging by independent entrepreneurs is responsible for a high percentage of diversion in communities where white goods are placed at the curb for collection. Both the cities of Winnipeg, Manitoba and Laval, Quebec reported that a high percentage, as much as one half, of all units placed at the curb, are collected by private operators. This represents between 29,116 and 40,742 tonnes or between 14 and 19 percent of all available units. It is assumed that virtually all such scavenged material is recycled.

Finally, there is the reuse sector consisting of second-hand appliance stores, charity resellers and appliance repair businesses. Information for this sector is sketchy. It has been estimated that as much as 10 percent of the units recovered through retail and apartment building programs are reconditioned and resold.

Similarly, it is estimated that about 10 percent of all units not collected through municipal, retail and apartment/condominium programs, are resold as second-hand appliances. This represents between 6,470 and 9,054 tonnes or as many as 120,000 units.

TABLE 11.1A Combined Municipal and Retail Recovery of White Goods

Sector	Quantity recovered (tonnes)		Percent recovered (tonnes)	
	Low	**High**	**Low**	**High**
Municipal	54,851	80,687	26%	38%
Major retailers	31,422		15%	
Independent retailers	28,490		14%	
Combined municipal + retail recovery	**114,763**	**140,599**	**55%**	**67%**
Balance managed through other recovery mechanisms and disposal	*68,888*	*94,724*	*33%%*	*45%*

TABLE 11.1B Recovery of White Goods through other Mechanisms

Sector	Quantity recovered (tonnes)	Percent recovered (tonnes)		
	Low	**High**	**Low**	**High**
*Private municipal diversion (entrepreneurial scavenging)	29,116	40,742	14%	19%
**Multi-unit buildings	4,185		2%	
***Direct 2nd hand resale/donation	6,470	9,054	3%	4%
Combined scavenging, multi-unit and reseller recovery	**35,586**	**53,981**	**19%**	**25%**

*Assumes scavenging rate of 50% of municipal units placed at the curb (amount unaccounted for after apartment building and second-hand recovery).

** Assumes 90% private sector recovery from multi-unit buildings (4,650 tonnes X 90%)
*** Assumes 10% recovery and resale of balance by second-hand resellers and charities

Total combined white goods diversion from municipal, retail, multi-unit building, scavenging and reseller programs are estimated between 150,349 and 194,580 tonnes or between 74 and 92 percent of available obsolete units.

TABLE 11.1C Estimated Total Diversion from all Recovery Channels

Sector	**Quantity recovered (tonnes)**	**Percent recovered (tonnes)**		
	Low	**High**	**Low**	**High**
Combined municipal and retail	114,763	140,599	55%	67%
Combined scavenging, multi-unit and reseller recovery	35,586	53,981	19%	25%
Total	**150,349**	**194,580**	**74%**	**92%**
Estimated quantity requiring disposal	*59,138*	*14,807*	*26%*	*8%*

Figure 2, on the next page, is a flow chart representation of the various management channels through which white goods flow to their final destination of reuse, recycling or disposal.

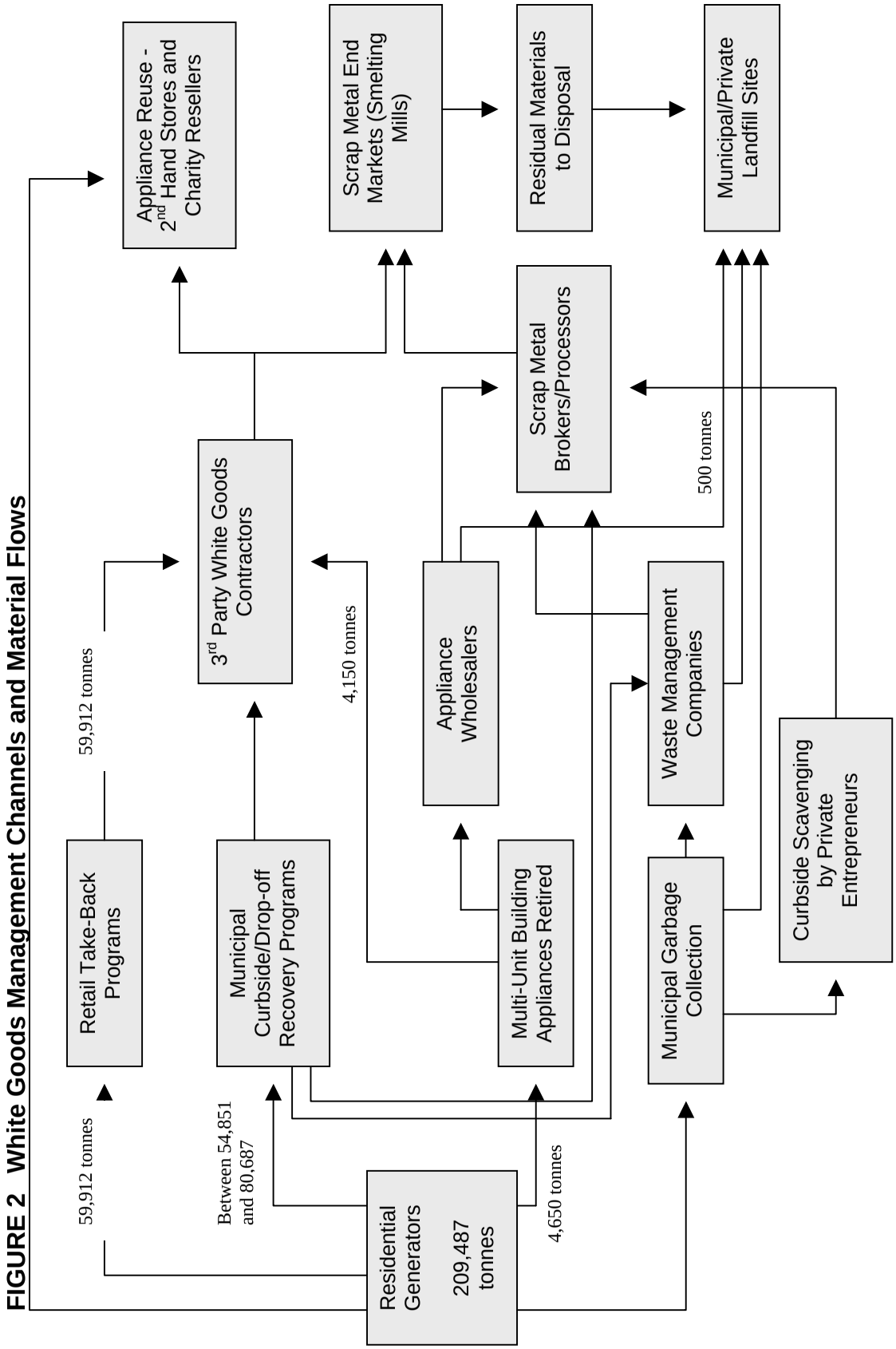


FIGURE 2 White Goods Management Channels and Material Flows

TABLE 11.2 Composition of White Goods from all Municipal Programs

Recovered (tonnes)	Shipment weighted composition of all appliances	Recovered by municipalities - low estimate (tonnes) 54,851	Recovered by municipalities - high estimate (tonnes) 80,687
Material	**kg per tonne of all appliances disposed**		
Steel	635.97	34,884	51,314
Iron	32.43	1,779	2,616
Sub total: Ferrous metal	**668.39**	**36,662**	**53,931**
Aluminum	36.99	2,029	2,985
Copper	32.81	1,800	2,647
Brass	1.29	71	104
Other Metal	9.74	534	786
Sub total: Non-ferrous metal	**80.84**	**4,434**	**6,522**
Rubber	6.75	370	544
Fiber & paper	0.85	46	68
Polypropylene	61.47	3,372	4,960
PS&HIPS	23.87	1,309	1,926
ABS	15.88	871	1,281
PVC	8.22	451	664
Polyurethane	32.67	1,792	2,636
Other pastics	15.77	865	1,272
Asst. mixed plastics	15.53	852	1,253
Sub total: Plastic	**173.41**	**9,512**	**13,992**
Fiberglass	23.25	1275	1,876
Glass	28.90	1585	2,332
Sub total: Glass	**52.16**	**2,861**	**4,208**
Refrigerant	0.61	33	49
Oil	2.06	113	166
Other materials typically removed before processing	**0.00**	**0**	**0**
Sub total: Materials typically removed before processing	**2.67**	**146**	**215**
Other	**14.95**	**820**	**1,206**
Total	**1000.00**		

TABLE 11.3 Composition of Materials Recovered through Retail Programs

	Shipment weighted composition of all appliances	Recovered by major retailers (tonnes)	Recovered by independent retailers (tonnes)	Total recovered by major and independent retailers (tonnes)
Recovered (tonnes)		31,422	28,490	59,912
Material	**kg per tonne of all appliances disposed**			
Steel	635.97	19,983	18,119	38102
Iron	32.43	1019	924	1943
Sub total: Ferrous metal	**668.39**	**21,002**	**19,043**	**40,045**
Aluminum	36.99	1162	1054	2216
Copper	32.81	1031	935	1966
Brass	1.29	41	37	78
Other Metal	9.74	306	277	584
Sub total: Non-ferrous metal	**80.84**	**2,540**	**2,303**	**4,843**
Rubber	6.75	212	192	404
Fiber & paper	0.85	27	24	51
Polypropylene	61.47	1,931	1,751	3,683
PS&HIPS	23.87	750	680	1,430
ABS	15.88	499	452	951
PVC	8.22	258	234	493
Polyurethane	32.67	1,027	931	1,957
Other pastics	15.77	495	449	945
Asst. mixed plastics	15.53	488	442	930
Sub total: Plastic	**173.41**	**5,449**	**4,940**	**10,389**
Fiberglass	23.25	731	662	1,393
Glass	28.90	908	823	1,732
Sub total: Glass	**52.16**	**1,639**	**1,486**	**3,125**
Refrigerant	0.61	19	17	36
Oil	2.06	65	59	123
Other materials typically removed before processing	0.00	0	0	0
Sub total: Materials typically removed before processing	**2.67**	**84**	**76**	**160**
Other	**14.95**	**470**	**426**	**895**
Total	**1,000.00**			

TABLE 11.4 Material Recovered through Combined Municipal and Retail Programs

Recovered (tonnes)	Shipment weighted composition of all appliances	Recovered by municipalities + retailers - low estimate (tonnes) 114,763	Recovered by municipalities + retailers - high estimate (tonnes) 140,599
Material	**kg per tonne of all appliances disposed**		
Steel	635.97	72,986	89,417
Iron	32.43	3,721	4,559
Sub total: Ferrous metal	**668.39**	**76,707**	**93,976**
Aluminum	36.99	4,245	5,201
Copper	32.81	3,765	4,613
Brass	1.29	148	182
Other Metal	9.74	1,118	1,369
Sub total: Non-ferrous metal	**80.84**	**9,277**	**11,365**
Rubber	6.75	774	949
Fiber & paper	0.85	97	119
Polypropylene	61.47	7,054	8,642
PS&HIPS	23.87	2,739	3,356
ABS	15.88	1,822	2,232
PVC	8.22	944	1,156
Polyurethane	32.67	3,750	4,594
Other pastics	15.77	1,809	2,217
Asst. mixed plastics	**15.53**	**1,782**	**2,183**
Sub total: Plastic	173.41	19,901	24,381
Fiberglass	23.25	2,669	3,269
Glass	28.90	3,317	4,064
Sub total: Glass	**52.16**	**5,986**	**7,333**
Refrigerant	0.61	70	86
Oil	2.06	236	290
Other materials typically removed before processing	0.00	0	0
Sub total: Materials typically removed before processing	**2.67**	**306**	**375**
Other	**14.95**	**1,715**	**2,101**
Total	**1,000.00**		

TABLE 11.5 Composition of Materials Recovered through Scavenging

Recovered (tonnes)	Shipment weighted composition of all appliances	Recovered by scavenging low estimate (tonnes) 29,116	Recovered by scavenging high estimate (tonnes) 40,742
Material	**kg per tonne of all appliances disposed**		
Steel	635.97	18,517	25,911
Iron	32.43	944	1321
Sub total: Ferrous metal	**668.39**	**19,461**	**27,232**
Aluminum	36.99	1,077	1,507
Copper	32.81	955	1,337
Brass	1.29	38	53
Other Metal	9.74	284	397
Sub total: Non-ferrous metal	**80.84**	**2,354**	**3,294**
Rubber	6.75	197	275
Fiber & paper	0.85	25	35
Polypropylene	61.47	1790	2,504
PS&HIPS	23.87	695	973
ABS	15.88	462	647
PVC	8.22	239	335
Polyurethane	32.67	951	1331
Other pastics	15.77	459	643
Asst. mixed plastics	15.53	452	633
Sub total: Plastic	**173.41**	**5,049**	**7,065**
Fiberglass	23.25	677	947
Glass	28.90	841	1177
Sub total: Glass	**52.16**	**1,519**	**2,125**
Refrigerant	0.61	18	25
Oil	2.06	60	84
Other materials typically removed before processing	0.00	0	0
Sub total: Materials typically removed before processing	**2.67**	**78**	**109**
Other	**14.95**	**435**	**609**
Total	1000.00		

12. Greenhouse Gas (GHG) Emission Reductions from White Goods Recycling

It has long been recognized that, in addition to conserving natural resources, manufacturing products from recycled materials can result in significant energy savings and reductions in the emissions of associated greenhouse gases.

But scientists and government authorities are far from agreement when it comes to quantifying these environmental savings. Considerable work has been conducted in Canada and internationally to develop conversion factors for estimating the energy savings and GHG reductions associated with the reduction, reuse, recycling, composting and disposal of a variety of materials commonly found in the waste stream.

In the context of the 1992 Kyoto Protocol signatory countries must reduce their GHG outputs, generally referred to in tonnes of carbon dioxide equivalent or eCO_2, to at least five percent below 1990 generation levels. For Canada the target is ten percent. Understandably, the methodologies for calculating total GHG emissions take on considerable political significance.

In North America a number of GHG studies have been conducted over the past five years on behalf the US and Canadian governments. These reports include the following:

- ✧ The Greenhouse Gas Emissions from Management of Selected Materials in Municipal Solid Waste, Office of Solid Waste Management, US Environmental Protection Agency;
- ✧ Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks, US EPA;
- ✧ Waste Management and Energy Savings: Benefits by the Numbers, a joint report by ICF Consulting and the US Environmental Protection Agency (Anne Choate, Susan Brown, Henry Ferland and Eugene Lee); and,
- ✧ Determination of the Impact of Waste Management Activities on Greenhouse Gas Emissions, (2001) - Final report submitted to Environment Canada by ICF Consulting, Enviros/RIS and Torrie Smith and Associates.

In addition, Canada now has a Raw Materials Database (CRMD), which is accessible over the Internet[23]. The CRMD includes inputs and outputs associated with the production of aluminum, glass, plastics, steel and wood products. For each product the raw material database describes material inputs, energy use, emissions to water, emissions to air and generation of wastes.

[23] Canadian Raw Materials Database, http://crmd.uwaterloo.ca/crmd/data.html

Despite the substantial volume of data on the subject, there are many reasons why parties cannot agree on the energy saved and emissions reduced from recycling. These reasons include:

- ✧ Differences over whether all the energy and emission reductions associated with recycling can be attributed if a material is collected in one place but shipped elsewhere for recycling. For example, aluminum cans that are collected in Canada are generally recycled in the United States;
- ✧ Primary sources of energy generation vary from one jurisdiction to another. Emissions profiles for hydro-electric power, coal burning, and nuclear energy, vary significantly;
- ✧ Nature of energy feedstocks varies. Different qualities of coal burned in different jurisdictions have different emission profiles;
- ✧ Manufacturing technologies vary. Newer technologies are generally more energy efficient thus resulting in fewer associated emissions, but the new technology may not have been widely adopted. For example, an arc furnace for smelting metals has a different environmental profile than a blast furnace;
- ✧ Nature of primary manufacturing feedstocks varies. When manufacturing metal and mineral products, the richness of the feedstock - the percentage of iron ore within rock -will determine how much energy is required to produce a unit of output, thus affecting emissions generation; and,
- ✧ The parameters or boundaries of the systems to be studied and compared. When comparing the production of a product made from virgin resources to one made from recycled material, what inputs and outputs should be included? Should the virgin material characterization focus solely on the smelting process or should it include the impacts of transporting raw materials from the mine to the smelter? Should it include the energy and emissions of digging and operating the mine? Should it include the energy, materials and emissions associated with the production of equipment to extract and transport resources?

Unfortunately, because of the dynamic nature of production systems, there are no hard and fast answers to some of these measurement questions. Ultimately, study boundaries are arbitrary in nature. Only through ongoing consultation and negotiation will standard protocols for these studies be established.

Natural Resources Canada and Environment Canada have formed an intergovernmental committee to establish GHG emission factors associated with a range of waste management approaches. ICF Consulting and Torrie-Smith Associates have been retained to update their 2001 report, *Determination of the Impact of Waste management Activities on Greenhouse Gas Emissions* using new energy data and expanded lifecycle analysis parameters.

Table 12.1 presents the most up-to-date conversion factors as proposed in that study. These recent conclusions are undergoing peer review as this report is being written and so should not be considered definitive.

TABLE 12.1 Final Emission Factors and their Components, GHG Emissions from Municipal Solid Waste Management Options (tonnes eCO_2/tonne)

	Net Source Reduction Emissions	Net Recycling Emissions	Net Composting Emissions	Net Anaerobic Digestion Emissions	Net Combustion Emissions	Net Landfilling Emissions
Newsprint	-3.82	-2.79	NA	-0.40	-0.05	-1.22
Fine Paper	-5.91	-3.20	NA	-0.34	-0.04	1.18
Cardboard	-5.17	-3.39	NA	-0.23	-0.04	0.29
Other Paper	-5.47	-3.27	NA	-0.23	-0.04	0.71
Aluminum	-9.31	-12.25	NA	0.01	0.01	0.01
Steel	-1.90	-1.13	NA	0.01	-0.99	0.01
Glass	-0.38	-0.12	NA	0.01	0.01	0.01
HDPE	-2.69	-2.26	NA	0.01	2.85	0.01
PET	-3.45	-3.61	NA	0.01	2.13	0.01
Other Plastic	-2.96	-1.79	NA	0.01	2.63	0.01
Food Scraps	NA	NA	-0.24	-0.23	0.01	0.80
Yard Trimmings	NA	NA	-0.24	-0.29	0.00	-0.33

Source: ICF Consulting and Torrie-Smith Associates, March 2004 (GHG values changed by expanding life cycle analysis and updating energy info) Initial report entitled "Determination of the Impact of Waste Management Activities on Greenhouse Gas Emissions", March 2001

Note: These data still require peer review. Also, further work needs to be done regarding open loop recycling and carbon sinks. As a result, the values may change again. NRCan and Environment Canada anticipate new numbers in the spring of 2005.

Using Net Recycling Emission factors in Table 12.1, Table 12.2 calculates total GHG emission reductions attributable to recycling of white goods recovered through combined municipal and retail systems. Updated conversion factors for metals other than steel and aluminum, primarily copper and brass, were not available at time of writing and are not included. Similarly, calculations for glass, plastics and other materials have not been made, as these materials are not generally recovered during white goods recycling operations. Because as many as 10% of the units recovered through retail programs may end up being reconditioned and resold as second-hand appliances, retail tonnage for these calculations has been adjusted down accordingly.

Total GHG emission reductions associated with municipal and retail recovery programs are estimated to be between 131,440 and 162,665 tonnes of eCO2.

TABLE 12.2A Calculation of Greenhouse Gas Emissions from Municipal and Retail White Goods Recycling (low and high recovery scenarios)

Material	Municipal recovery-low estimate	Retail recovery less 10%	Combined recovery	GHG emissions reduced	
				eCO_2/tonne	tonnes eCO_2
Ferrous	36,662	36,040.5	72,702.5	1.13	82,154
Aluminum	2,029	1,994.4	4,023.4	12.25	49,287
					131,440

Material	Municipal recovery-high estimate	Retail recovery less 10%	Combined recovery	GHG emissions reduced	
				eCO_2/tonne	tonnes eCO_2
Ferrous	53,931	36,040.5	89,971.5	1.13	101,668
Aluminum	2,985	1,994.4	4,979.4	12.25	60,998
					162,665

TABLE 12.2B Calculation of Greenhouse Gas Emissions Reduced through other White Goods Diversion Programs (scavenging, multi-unit buildings, resale)

Material	Low recovery estimate	GHG emissions reduced	
		eCO_2/tonne	tonnes eCO_2
Ferrous	23,843	1.13	26,942
Aluminum	1,317	12.25	16,133
			43,075

Material	High recovery estimate	GHG emissions reduced	
		eCO_2/tonne	tonnes eCO_2
Ferrous	36,167	1.13	40,869
Aluminum	1,997	12.25	24,463
			89,795

13. Environmental Considerations

While the main focus of this report is to determine quantities of materials being recycled through end-of-life white goods recovery programs and their implications for greenhouse gas reductions, other environmental benefits can be derived from end-of-life white goods recovery.

This section of the report outlines the impact current practices have on two specific environmental issues, specifically the releases of ODS substances and mercury into the environment. It also outlines potential positive environmental benefits that could be achieved through the expansion of programs to address these substances.

13.1 Ozone Depleting Substances

Certain chemicals are recognized as ozone-depleting substances (ODS) because they break down in the stratosphere and release chlorine or bromine, which destroy the ozone layer. Most of these substances are also greenhouse gases. Ozone-depleting substances are used as foam blowing agents, solvents, fire extinguishing agents and refrigerants for air conditioning and refrigeration applications. The most commonly known ODS are Chlorofluorocarbons (CFCs)

There is an estimated average of 150 grams of CFCs in the cooling system and any where from 260-500 grams in the insulation of fridges and freezers. The amount of CFCs in insulation varies depending on the thickness of the foam in the fridge and would be higher for Freezers.[24] Older large refrigerators manufactured in North America may have contained up to a kilogram of CFCs.

However, it should be noted that refrigerator-freezer manufacturers in North America stopped using CFCs in 1994. From 1994 to 2003, HCFCs were used in the foam, and HFCs were used as the refrigerant. HFCs are now used in the foam and as a refrigerant. HFCs do not contain any chlorine and therefore are not an ODS.

Under the Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal Protocol), many countries, have measures in place for the recovery CFCs from the cooling systems in refrigeration units.

Canada signed the Montreal Protocol in 1987. As a result of Canada's commitments to this global environmental agreement, the Canadian Council of Ministers of the Environment (CCME) agreed in November 1990 that the federal and provincial/territorial governments would share regulatory responsibility for ozone layer protection. The federal government is responsible for implementing

[24] Friends of the Earth Scotland, Recovery of Ozone Depleting Substances from Domestic Refrigeration Equipment, http://www.foe-scotland.org.uk/nation/Recovery_of_CFCs_report.pdf, July 2001.

the provision of the Montreal Protocol on Substances that Deplete the Ozone Layer, including controls on the manufacture and import of ozone-depleting substances (ODS); and the provinces and territories implement programs for the recovery and recycling of these substances.

Environment Canada implements the provisions of the Montreal Protocol on behalf of the Canadian federal government through the Ozone Depleting Substances Regulations (ODSR) under the Canadian Environmental Protection Act (CEPA).

These regulations control the import, manufacture, use, sale and export of ODS. They require gradual reductions of the production and import of these substances according to the following fixed schedule established by the Montreal Protocol:

Substance	**Reduction**	**Date**
Halons	100%	January 1, 1994
Carbon tetrachloride	100%	January 1, 1995
CFCs	100%	January 1, 1996
Methyl chloroform	100%	January 1, 1996
HBFCs	100%	January 1, 1996
Methyl bromide	25% 50% 70% 100%	January 1, 1998 January 1, 2001 January 1, 2003 January 1, 2005
HCFCs	35% 65% 90% 99.5% 100%	January 1, 2004 January 1, 2010 January 1, 2015 January 1, 2020 January 1, 2030

All 10 provinces and 3 territories have established regulations addressing ODS pollution prevention and the reduction of ODS emissions. Environment Canada has developed similar regulations, the Federal Halocarbon Regulations (FHR), for Federal facilities.

Canada's Strategy to Accelerate the Phase-Out of CFC and Halon Uses and to Dispose of the Surplus Stocks (Phase-Out Strategy) was approved by the CCME on May 1, 2001.

There are two separate components of the Phase-Out Strategy. The first is general in nature, which provides the "infrastructure" needed to achieve the objectives of the Strategy. The "infrastructure" consists of extended producer responsibility programs, consideration of market force instruments and communication of information to stakeholders.

The second component of the Phase-Out Strategy consists of specific phase-out approaches for individual industry sectors. These phase-out approaches will become regulatory requirements once the federal, provincial and territorial governments adopt regulations to implement the Phase-Out Strategy.

A summary of the sector specific approaches for the air conditioning and refrigeration applications is provided in the following table:

Sector	**Approach**
Mobile Air Conditioning	Prohibit refill with CFCs as soon as possible.
Mobile Refrigeration	Prohibit refill with CFCs effective 2003.
Household Appliances	Enhance implementation of existing recovery programs; If necessary, add a ban on converting equipment to use CFCs.
Commercial Refrigeration and Air Conditioning	Staged CFC refill ban effective by year: equipment < 5 HP: 2004 equipment 5 - 30 HP: 2005 equipment > 30 HP: 2006.
Chillers	Limit releases from low pressure purges to less than 0.1 kg/kg air effective 2003; Require conversion or replacement of CFC-containing chillers at next overhaul effective 2005.

Regulations that prohibit the release of ODS are in place in all provinces and territories and the substances being regulated are relatively consistent throughout. Certain uses are covered by the federal ODS regulations, reducing the need for provinces to regulate them.

To varying degrees, all provinces and territories have established regulations concerning the cooling systems in refrigerators and freezers. They all prohibit the release of ODS, require mandatory reuse and recycle of ODS and require reports and records. Eleven jurisdictions require refrigerant removal prior to disposal and have implemented labeling requirements. Eleven of the 12 jurisdictions require that technicians must be trained and certified, as well,

recharging and topping up is prohibited unless a leak test is performed and repairs are made. All but two jurisdictions prohibit or limit leak testing using ODS.

Using data on the quantity of fridges and freezers expected to enter the waste stream in 2002, we have determined that municipal and retail white goods recovery programs would recover between 66,413 and 82,111 kilograms of ODS from the cooling systems. Details of the calculations are provided below in Table 13.1

TABLE 13.1 Refrigerant Recovered by Municipal and Retail Programs (2002)

	A	B	C	D
Sector	**Generation of Refrigerators and Freezers (# of units)**	**# Units Recovered**	**ODS Per Unit in Cooling Systems (grams)**	**ODS Recovered (kilograms) (B X C)**
Municipal Low	805,000	209,300	150	31,395
Municipal High		313,950	150	47,093
Retail		233,450	150	35,018

Neither Canada, nor the United States have ODS regulations that apply to recovery of blowing agents from insulating foam at end of life. At present, only the European Union has such regulation.

Council Regulation No 2037/2000 on Ozone Depleting Substances (ODS), requires the removal of controlled ODS from refrigeration equipment before appliances are scrapped. This applies to ODS in the insulating foam as well as to the refrigerant in the cooling system.[25]

A 2001 study by Friends of the Earth Scotland estimates that extending the processing of the appliances already treated to include foam degassing would cost between £1.42 ($3.54 CAD) and £2.85 ($7.11 CAD) per unit. Degassing all the discarded appliances in Scotland could cost as much as 10 times more.[26]

As mentioned above, in North America there are, at present, no requirements for degassing insulation foam. Shredding one discarded refrigerator can release more than 100 grams of CFC-11 into the environment. All 500 grams of CFC gas in the insulation of each refrigerator can eventually seep from the appliances

[25] EUROPA – Environment, http://europa.eu.int/comm/environment/index_en.htm
[26] Friends of the Earth Scotland, Recovery of Ozone Depleting Substances from Domestic Refrigeration Equipment, http://www.foe-scotland.org.uk/nation/Recovery_of_CFCs_report.pdf, July 2001.

over the next 300 years[27], although there is evidence that much of that will degrade by microbes in landfills[28].

The US EPA has launched a voluntary initiative to help citizens dispose of their old refrigerators/freezers in an environmentally friendly manner by providing general information, recycling contacts, and answers to frequently asked questions. As part of this initiative, ARCA Inc. and JACO Environmental received a US EPA Stratospheric Ozone Protection award in 2004 for including proper CFC-containing foam disposal in their operations.[29]

By correlating the number of fridges and freezers entering the Canadian waste stream in 2002 with the amount of ODS in the insulating foam, we have been able to determine that the total amount of ODS contained in fridges and freezers entering the Canadian waste stream to be between 209,300 and 402,500 kilograms (depending the mix of fridges and freezers).

TABLE 13.2 ODS in Fridge and Freezer Insulation Foam entering Waste Stream

	A	B	C
Range	**Generation of Refrigerators and Freezers (# of units)**	**Amt of ODS per unit (grams)**	**Total ODS in Insulating Foam of End-of-Life White Goods (Kilograms)**
Low Range	805,000	260	209,300
High Range		500	402,500

Using the municipal and retail recovery figures established earlier in this report and the 100 gram CFC-11 quick release statistic mentioned above, we can expect that between 44,275 and 54,740 kilograms of CFC-11 will be released into the environment 2002 as a result of shredding. However, as mentioned earlier, CFCs were not used in refrigerator-freezers in North America after 1994. Given a typical expected life of between 8 to 16 years for a refrigerator-freezer, it should be noted that as of 2002 the release of CFCs from refrigerator-freezers will reduce considerably. There should be virtually no emissions after 2010.

[27] American Chemical Society, Refrigerator Disposal Releases Ozone-Depleting Chemicals, Journal of the American Chemical Society, http://www.globaltechnoscan.com/27June-3July01/ozone.htm, July 2001.
[28] Peter Kjeldsen Charlotte Scheutz, Technical University of Denmark, *Attenuation of Alternative Blowing Agents in Landfills; http://www.er.dtu.dk/publications/fulltext/2003/MR2003-145.pdf*
[29] US EPA, Safe Disposal Requirements for Household Appliances, http://www.epa.gov/ozone/title6/608/disposal/household.html

Any decisions to make substantial infrastructure investments in establishing facilities for the purpose recovery, destruction, and/or disposal of blowing agents, should take this declining material flow into account through cost-benefit analysis.

13.2 Mercury Switch Removal

a) Use of Mercury in Appliances

Because of the unique properties of mercury (it is a conductive metal that can be either a liquid or vapour over normal temperature ranges), it has been used for decades in appliances in one of three ways:

1) As a component of switches found in some models of chest freezers and a few models of washing machines,
2) As part of the safety gas shut off system in gas fueled ranges with pilot lights, and
3) In the fluorescent lights that backlight the control panels on some stoves and washing machines.

A nine-month pilot was carried out in 2001 at two white goods receiving sites in the Regional Municipality of Niagara to investigate the amount and type of appliances that contain mercury switches and sensors, and to determine the site and labour requirements of a mercury switch/sensor removal program. Of the 1,314 appliances received, 120, or 9 percent were found to contain mercury devices. Virtually all of the appliances were old chest freezers, although three gas ranges were also found.

The results of the pilot indicated that:

1) The time taken to locate and remove a switch from those chest freezers having a lid-switch is 1-2 minutes. The switches are relatively easily accessible in the lid of the freezer and at most, the plastic casing in the lid has to be broken to remove the switch;
2) The switches were generally found to be in good condition and posed no threat of leakage when handled;
3) Segregation of appliances suspected of containing mercury devices did not pose significant space or labour requirements, particularly as freezers must be segregated anyway for CFC removal.
4) The estimated cost for adding mercury switch/sensor removal to an existing white goods program ranges from $450 - $1000 for year one, based on receiving an anticipated 15 chest freezers and one gas appliance per month. This translates to an operating cost of $1.20 - $1.90 per appliance, significantly less than the unit cost for CFC extraction in most programs.

The amount of mercury contained in these components is approximately 2 grams in a mercury diostat found in a pilot-light gas range and 1 gram in a mercury lid-light switch in a chest freezer.

Program costs can be expected to vary. During the course of the pilot, one Ontario city added mercury switch removal to its white goods program at no extra cost from the contractor. The only additional cost was that of disposal of the switches. This translated into a few cents per appliance.

With the results of the pilot and the information provided by the operators at the white goods handling sites, a manual and video were developed to assist municipal staff and decision makers in adding mercury switch and sensor removal to their existing white goods programs.

Eight programs reported that they currently remove mercury switches from appliances. These are:

- Kirkland Lake
- Markham
- McNab Braeside
- Niagara (Region)
- Orillia,
- Owen Sound
- Peterborough (City)
- Waterloo (Region)

Of these, only three programs (Niagara, Owen Sound and Orillia) were doing so in 2002. Unfortunately, none were able to provide information on the quantity of switches or weight of mercury removed. However, using 2002 tonnages to provide an estimate of mercury removed by all the programs now removing switches and sensors, approximately 46 kilograms of mercury is being removed from the waste stream by these programs.

An additional three programs (Guelph, Norfolk County, Peterborough County) indicated that mercury switch removal is to be implemented in 2004. The Township of Southgate also indicated plans to implement "as soon as possible." Together these communities represent an additional potential five kilograms of mercury.

Seven other Ontario programs have indicated that they are considering the addition of mercury switch and sensor removal to their white good programs when tendering their next disposal contracts. If all were to go ahead, this would represent an additional 45 kilograms of mercury.

Of the remaining programs with no immediate plans to add mercury switch and sensor removal, the stated reasons included:

- Perceived cost, lack of awareness of issue among decision makers;
- Lack of staff resources/time to research or implement;
- Removal is not required by regulation; and,
- Absence of a municipal white goods program.

Manufacturers discontinued the use of mercury-containing lid-light switches in chest freezers in 2000. In addition, the practice of using mercury-containing off-balance switches in washing machines was discontinued in 1972 and due to the average life span, these appliances will have moved through the recycling infrastructure by this time.

Gas ranges with pilot lights have continued in manufacture, although the numbers produced each year is smaller. According to the component manufacturers, replacements for these safety controls have not existed.[30])

An ARIC bulletin #8 exists from the Appliance Recycling Information Center that describes the amounts of mercury, number of units produced, and location in the product. The diagrams and instructions can assist qualified individuals in the removal of these components before the appliance would be crushed or shredded.

[30] Appliance Recycling Information Centre (ARIC) Bulletin #8, August 1998

14. Conclusions

In this section, a summary of the major findings is presented along with some of the broader conclusions that can be derived from them.

14.1 Summary of Findings

International Experience

With the exception of Japan, whose historic recovery rate is 30 percent, most countries calculate current recovery rates between 50 and 80 percent.

European countries and Australia address white goods recovery in the broader context of waste electrical and electronic equipment, whereas Japan and US states tend to address white goods as distinct from other electrical and electronic equipment.

Japan, Europe, the UK, and 19 US states have enacted bans on landfilling of white goods (a further 18 US states require white goods to be separated from the mixed waste stream at the landfill for recycling).

Australian efforts are being driven by four key industry associations and are voluntary in nature.

Japan, Europe and the UK have legislated extended producer responsibility. In almost all cases, manufacturers and retailers have opted to develop collective mechanisms for take-back and recycling of end-of life white goods. Municipalities are generally required to provide household collection services for end-of life appliances.

A number of jurisdictions (including Japan, 4 European countries and 3 US states) require consumers to pay a visible fee or tax for the disposal of white goods.

Generation and Material Composition

The estimated life spans of white goods range in Canada between 8 and 16 years depending on the type of appliance.

In 2002, approximately 2.8 million white goods weighing 209,685 tonnes reached the end of their useful life. This represents approximately one appliance for every four households, or 7.1 kilograms of white goods per person per year.

The single largest material in white goods is steel, which accounts for about 65 percent by weight (this percentage varies considerably by appliance category). Plastics and other materials used for insulation account for about 27.8 percent.

The typical weight of an appliance entering the waste stream in 2002 is about 74.8 kg.

Packaging

It is estimated that the typical weight of all new appliance packaging sold in Canada is about 6.32 kilograms of which 72 percent is corrugated cardboard and that the total weight of packaging (in 2002) was roughly 24, 587 tonnes. The composition of packaging associated with new appliances is changing. Shrink-wrap is increasingly used to replace corrugated cardboard.

A small percentage of white goods packaging actually enters the municipal waste stream. The overwhelming majority of retailers either take back packaging or defrock appliances at the warehouse/distribution centre prior to shipping.

It is estimated that 69 percent of appliance packaging is managed by retail stores, 15 percent by the builder market and 16 percent by municipalities.

Municipal White Goods Recovery Programs

94 percent of municipalities surveyed have some sort white goods recovery program. Program design and financing mechanisms vary considerable among jurisdictions.

By far, the most common type of service is the permanent depot facility. This is especially true of provinces west of Ontario. Curbside collection is also offered on either a weekly, bi-weekly, monthly or seasonal basis. This is more often the case in the provinces of Ontario, Quebec and Nova Scotia. Population within a community tends to determine the level of service provided.

The majority of municipalities charge the public a fee to help offset ODS management and other handling costs.

Roughly 64 percent of municipalities surveyed reported that they track quantities of white goods recovered. The quality of data varies considerably from one program to another. There are no standard measurement protocols for tracking white goods diversion.

It is estimated that municipalities participating in the study recovered 30, 924 tonnes of white goods in 2002. This translates into an average of 2.26 kg per capita in communities that have white goods programs and 2.11 kilograms per capita for all reporting municipalities.

If this level of recovery is considered representative of all municipalities in Canada, total municipal diversion of white goods in Canada in 2002 was between 54,851 and 80,687 metric tonnes.

In total, municipal programs are thought to divert between 26 and 38 percent of end of life white goods entering the waste stream in 2002.

Determining the relative effectiveness of curbside collection is difficult because a percentage of municipalities that offer curbside collection also provide depot service. The overwhelming majority of municipalities do not track their curbside and depot programs separately.

Many municipalities do not have a clear picture of the revenues and costs associated with their white goods programs. This is due to a combination of factors including:

- ✧ Poor understanding of quantities managed;
- ✧ Costs are hidden in other administrative, operational and promotional budgets;
- ✧ Range of program types (E.g. curbside, depot, special days);
- ✧ Multiple white goods contracts with different contractors responsible for different service areas within a jurisdiction;
- ✧ No rationale for detailed tracking;
- ✧ Revenues are hidden in total scrap metal revenues; and,
- ✧ Lack of a generally accepted waste management accounting practice.

Both revenues and costs vary widely, even among communities of similar populations and geographic proximity.

Of the 22 programs that reported both revenues and expenses, 11 were determined to operate at a net cost while nine showed a revenue surplus.

Of communities that reported both costs and revenues, the national weighted net average program cost was $37.68 per tonne. The net per capita cost of these programs, representing about 18 percent of the national population, is 7.82 cents. This translates into about 20 cents per household.

Applied nationally to all communities and households, the net annual cost of municipal white goods management would be approximately $2.3 million.

Because of the potential for both costs and revenues to be hidden in other municipal waste budgets, financial data presented in this report is not conclusive and should be considered representative only.

Multi-Unit Residential Building Recovery Programs

Condominiums contribute virtually no end-of-life appliances to the municipal waste stream because unit owners must dispose of their own end-of-life appliances. Most opted for retail-take back programs or contact a contractor to remove old appliances from their units.

Fewer than ten percent of the appliances generated by private apartments and public housing are thought to enter the municipal waste stream. Property owners and managers generally have established arrangements with repair stores, resellers, scrap haulers and appliance suppliers.

It is estimated that multi-unit residential buildings generate 62,507 appliances in a given year and that about 4,185 tonnes of white goods are diverted for recycling from these buildings

Retail Recovery Programs

The majority of retailers have policies in place to remove an old appliance from a customer's premises when a new one is delivered. However, policies within a company often vary from region to region across Canada depending on, independent franchisee decisions, contracts with third party delivery companies, and access to used appliance purchasers or scrap metal companies. Competitive market conditions also affect regional take-back policies.

As with municipalities, retailers, whether large or small, were unable to provide accurate records of the number of obsolete units recovered. Instead, recovery was expressed as an estimate of percentage of new units sold.

It is estimated that major retailers diverted approximately 420, 300 units of white goods in 2002 with a combined weight of approximately 31,422 tonnes. Independent retailers are estimated to recover approximately 380,000 units or 28,490 tonnes in 2002.

Estimated Waste Diversion Flows in Canada

Municipalities across Canada recovered between 26 and 38 percent of all obsolete white goods generated in 2002. This represents between 54,851 and 80,687 metric tonnes.

Major retailers are attributed with taking back approximately 15 percent of all obsolete white goods or 31,422 tonnes while independent retailers diverted an almost equivalent amount, 14 percent or 28,490 tonnes. Combined, the retail sector diverted 59,912 tonnes or 29 percent of all available end-of-life white goods.

The total diversion attributable to municipal and retail recovery programs, therefore, is estimated to be between 114,763 and 140,599 tonnes. Expressed as a percentage, municipal and retail programs diverted between 55 and 67 percent of end-of-life white goods in 2002.

The balance of white goods that are managed through other means such as curbside scavenging, donation or resale, apartment building recycling and

disposal is estimated to be between 68,888 and 94,724 tonnes or 33 to 45 percent of total generation.

Among these 'other' systems apartment and condominium buildings are thought to manage about 62,000 units weighing roughly 4,650 tonnes. Of this quantity, the bulk is sold to private companies. It is thought that less than 10 percent are landfilled. This means that about 4,185 tonnes are diverted from multi-unit buildings primarily through recycling.

Finally, there is the reuse sector consisting of second-hand appliance stores, charity resellers and appliance repair businesses. It has been estimated that as many as 10 percent of the units recovered through retail and apartment building programs are reconditioned and resold.

If accurate, this would equate to roughly 80,000 resale units per year. Of total materials recovered through retail programs, these 80,000 resale units would mean that the recycling of about 6,000 tonnes of collected material would be deferred until the second-hand units reach the end of their useful lives.

Energy Savings and Greenhouse Gas Emissions Attributable to White Goods Recycling

Considerable work has been conducted in Canada and internationally to develop conversion factors for estimating the energy savings and GHG reductions associated with the reduction, reuse, recycling, composting and disposal of a variety of materials commonly found in the waste stream.

Using the conversion factors available at the time of writing this report, it is estimated that recycling of steel and aluminum recovered through municipal and retail white goods programs resulted in emission reductions of between 131,440-162,665 tonnes of carbon dioxide equivalent in 2002.

Environmental Considerations

All 10 provinces and 3 territories have established regulations concerning ODS pollution prevention and the reduction of ODS emissions. The federal government has developed similar regulations for federal facilities.

It is estimated that municipal and retail recovery programs managed between 66,413 and 82,111 kilograms of chlorofluorocarbons (CFCs) from refrigerator and freezer cooling systems in 2002.

The total amount of ODS from foam insulation in fridges and freezers entering the waste stream in 2002 is estimated to be between 209,300 and 402,500 kilograms. Insulation foam is not degassed in Canada.

Nine percent of appliances recovered in a 2001 pilot program were found to contain mercury devices.

Eight Canadian municipalities reported that they currently remove mercury switches from appliances. Three additional municipalities are preparing to implement mercury recovery programs, while another seven indicated they are considering the addition of mercury switch and sensor removal to their white goods programs in future.

14.2 Broader Observations

Concern about the disposal of white goods is an issue that is international in scope. All of the jurisdictions examined either have, or are developing, mechanisms to increase recovery and recycling rates for white goods.

In Canada, it is estimated that between 74% and 92% of white goods are recovered for recycling or reuse. This compares favourably with other international jurisdictions where white goods recovery is mandated. By and large, Canada has achieved these recovery rates without the regulatory or financial requirements that exist in other countries.

In Canada, the only province or territory to implement landfill bans on white goods is British Columbia. BC also appears to be the only province where a financial incentive is offered to encourage white goods recovery.

A principal challenge in estimating white goods recovery rates in Canada is the lack of standardized reporting protocols for municipal and retail white goods recovery programs. Work in this area could help to:

- ✧ Corroborate the findings of this study; and,
- ✧ Significantly improve Canada's ability to track the recovery of end-of life white goods and associated benefits such as materials recovered, energy savings, GHG emissions reductions and other environmental benefits.

Accurate tracking mechanisms are required not only for estimating current recovery rates, but are preconditions for determining:

- ✧ Reasonable targets for enhanced recovery; and,
- ✧ Success factors for efficient and effective recovery programs.

At present there is considerable variance between the costs and revenues associated with municipal white goods recovery programs, even among communities of similar size and close geographic proximity. Further study is required to develop key success factors that could assist municipalities to maximize the efficiency and effectiveness of their white goods recovery programs.

Further study is required to determine the feasibility of significantly increasing white goods recovery rates in Canada and the most effective means for achieving enhanced recovery.

Given the nature of the reseller market, it is virtually impossible to track with any accuracy the quantity of end-of-first-life appliances whose overall life-span is increased through refurbishment and resale. Further research could examine how promotion and incentives (E.g. BC Hydro's Second Fridge Buy-Back Program) could increase the retirement of end-of-first life appliances to promote materials recovery, energy efficiency, GHG emissions reductions and other environmental benefits.

Research on the Canadian scrap metal industry is inconclusive, largely due to a lack of participation on the part of scrap metal companies. The industry associations representing these companies should be engaged to lend credibility to the research and to obtain increased buy-in from scrap companies.

The findings from Canadian pilot programs suggest that mercury recovery could be integrated more broadly into municipal and retail white goods recovery programs with only minimal increases to program costs and time requirements. Further study on international experience is required to corroborate Canadian findings. In addition, further study is required on effective means for increasing the prominence of mercury recovery in white goods programs.

15. Recommendations

The Canadian Appliance Manufacturers Association, in consultation with Natural Resources Canada, should:

1. Work with the Federation of Canadian Municipalities (FCM) and its members to develop a standardized reporting framework for municipal white goods recovery programs;

2. Work with a small representative sample of Canadian municipalities over a one-year period to implement a standardized reporting framework and accurately track Canadian municipal white goods recovery rates;

3. Promote the increased use of a standardized reporting framework for municipal white goods recovery programs among FCM members;

4. Conduct research with the FCM on success factors for efficient/effective municipal white goods recovery and disseminate the findings to Canadian municipalities;

5. Examine how to increase the capacity of smaller municipalities, particular those with populations of less than 100,000, to run white goods recovery programs.

6. Work with the Retail Council of Canada and its members to develop a standardized reporting framework for large retailers that is sensitive to retailer issues around confidentiality of sales information;

7. Examine the potential and feasibility of buy-back incentive programs, such as BC Hydro's Second Fridge Buy-Back Program, to encourage the early retirement and recycling of energy inefficient appliances;

8. Work with the associations representing the Canadian scrap metal industry, and their membersto develop more accurate estimates of the total quantity of scrap metal from white goods being recycled as well as the quantities being lost to the reseller market and landfilling.

Appendices

APPENDIX A: Manufacturer Survey

INTRODUCTION

CAMA is participating in a “Project to Establish Baseline Data and Tracking System for the Generation and Diversion of Obsolete White Goods from Residential Sources in Canada", partly commissioned by Natural resources Canada (NRCan). One of the objectives of this study is to develop baseline figures for the number of major appliances sold, reused, recycled, stored and disposed each year in Canada. We also will examine the amount of packaging disposed of annually with an analysis of how much is deposited at the curbside and how much is handled by the retailer.

We are requesting the co-operation of our members in providing input. As you know, CAMA has annual sales data for the equipment being studied. We would like your input on the weight and composition, as well as lifespan of major appliances.

Please take some time to review the following questions and give your input where appropriate.

Thank you for your help. For those members who respond to the survey, we will forward a copy of the final results once they are made available.

SURVEY COMPLETED BY:

Name: _____

Company: _____

1. EQUIPMENT WEIGHT AND COMPOSITION

We would like to determine the total weight of the equipment that will eventually be disposed into the waste stream at the end of its usable life. As the weight of the equipment may change over the years with the introduction of new technologies and materials, we would like you to estimate the average weight of a typical model at various points in the past.

For those categories in which you have information, please provide average model weight in kilograms: (I kg = 2.2 pounds)

Year of Sale:	1970	1975	1980	1985	1990	1995	2000
Refrigerators							
under 6.5 cu. ft							
6.5 – 12.4 cu. ft.							
12.5 - 16.4 cu. ft.							
16.5 - 19.4 cu. ft							

19.5 - 22.4 cu. ft							
22.5 cu. ft. and over							
Freezers							
Chest							
Upright							
Dishwashers							
Portable							
Built-in							
Clothes Washers							
Full Size							
Compact							
Clothes Dryers							
Full Size							
Compact							
Ranges							
24"							
30" Manual Clean							
30" Self Clean							

We would like to determine the material composition of the appliances that will be disposed into the waste stream at the end of their usable life. We are interested in the relative percentage of the weight of each appliance represented by ferrous metals, non-ferrous metals, plastics and other materials. As the proportion of each category may change over the years with the introduction of new technologies and materials, we would like you to estimate the relative proportions for a typical model at various points in the past.

Year of Sale:	**1970**				**1975**			
Percentage Composition:	**Ferrous**	**Non-Ferrous**	**Plastics**	**Other**	**Ferrous**	**Non-Ferrous**	**Plastics**	**Other**
Refrigerators								
Under 6.5 cu. ft								
6.5 - 12.4 cu. ft.								
12.5 - 16.4 cu. ft.								
16.5 - 19.4 cu. ft								
19.5 - 22.4 cu. ft								
22.5 cu. ft. and over								
Freezers								
Chest								
Upright								
Dishwashers								
Portable								
Built-in								
Clothes Washers								
Full Size								
Compact								
Clothes Dryers								
Full Size								

Compact								
Ranges								
24"								
30" Manual Clean								
30" Self Clean								
Year of Sale:	**1980**				**1985**			
Percentage Composition:	**Ferrous**	**Non-Ferrous**	**Plastics**	**Other**	**Ferrous**	**Non-Ferrous**	**Plastics**	**Other**
Refrigerators								
under 6.5 cu. ft								
6.5 - 12.4 cu. ft.								
12.5 - 16.4 cu. ft.								
16.5 - 19.4 cu. ft								
19.5 - 22.4 cu. ft								
22.5 cu. ft. and over								
Freezers								
Chest								
Upright								
Dishwashers								
Portable								
Built-in								
Clothes Washers								
Full Size								
Compact								
Clothes Dryers								
Full Size								
Compact								
Ranges								
24"								
30" Manual Clean								
30" Self Clean								
Year of Sale:	**1990**				**1995**			
Percentage Composition:	**Ferrous**	**Non-Ferrous**	**Plastics**	**Other**	**Ferrous**	**Non-Ferrous**	**Plastics**	**Other**
Refrigerators								
under 6.5 cu. ft								
6.5 - 12.4 cu. ft.								
12.5 - 16.4 cu. ft.								
16.5 - 19.4 cu. ft								
19.5 - 22.4 cu. ft								
22.5 cu. ft. and over								
Freezers								
Chest								

Upright								
Dishwashers								
Portable								
Built-in								
Clothes Washers								
Full Size								
Compact								
Clothes Dryers								
Full Size								
Compact								
Ranges								
24"								
30" Manual Clean								
30" Self Clean								
Year of Sale:	**2000**							
Percentage Composition:	**Ferrous**	**Non-Ferrous**	**Plastics**	**Other**				
Refrigerators								
under 6.5 cu. ft								
6.5 - 12.4 cu. ft.								
12.5 - 16.4 cu. ft.								
16.5 - 19.4 cu. ft								
19.5 - 22.4 cu. ft								
22.5 cu. ft. and over								
Freezers								
Chest								
Upright								
Dishwashers								
Portable								
Built-in								
Clothes Washers								
Full Size								
Compact								
Clothes Dryers								
Full Size								
Compact								
Ranges								
24"								
30" Manual Clean								
30" Self Clean								

2. APPLIANCE LIFESPAN

We are trying to assess the average lifespan of each appliance type. As above we would like to get some idea of whether the lifespan has changed over the years. Therefore, we ask you to consider the average lifespan for models bought in various years.

Year of Sale:	1970	1975	1980	1985	1990	1995	2000
Refrigerators							
under 6.5 cu. ft							
6.5 - 12.4 cu. ft.							
12.5 - 16.4 cu. ft.							
16.5 - 19.4 cu. ft							
19.5 - 22.4 cu. ft							
22.5 cu. ft. and over							
Freezers							
Chest							
Upright							
Dishwashers							
Portable							
Built-in							
Clothes Washers							
Full Size							
Compact							
Clothes Dryers							
Full Size							
Compact							
Ranges							
24"							
30" Manual Clean							
30" Self Clean							

The previous question deals with the average age of appliances. However, in any given year there will be a considerable range in the ages of the appliances that are disposed of. We would like to get an understanding of this range. Taking 2002 as a base, we would like your opinion (or, if you have research on this subject, your actual estimation) of the percentage of the total number of appliances disposed of that were sold during the following year ranges:

Year of Sale:	1970 - 1974	1975 - 1979	1980 - 1984	1985 - 1989	1990 - 1994	1995 - 1999	2000 - 2002
Refrigerators							
under 6.5 cu. ft							
6.5 - 12.4 cu. ft.							
12.5 - 16.4 cu. ft.							
16.5 - 19.4 cu. ft							

19.5 - 22.4 cu. ft							
22.5 cu. ft. and over							
Freezers							
Chest							
Upright							
Dishwashers							
Portable							
Built-in							
Clothes Washers							
Full Size							
Compact							
Clothes Dryers							
Full Size							
Compact							

Ranges							
24"							
30" Manual Clean							
30" Self Clean							

Please add any additional comments you may have on the trends in the lifespan and usage of those appliances with which you are familiar.

Your Comments:

3. PACKAGING

The disposal of appliance packaging is becoming an important issue. In many cases, the selling retailer removes the packaging and processes it. In others, the consumer leaves the packaging at the curbside for disposal. We would like to determine the average weight and composition of the packaging. We would also like to understand the breakdown of sales to small, mid-size and large retailers so that when we discuss disposal policies with retailers we can better understand what proportion each sector represents. Please provide your estimates for appliances sold in 2002.

This question concerns the total weight of the packaging and the proportion in percentage represented by the different materials used in the packaging

	Total Weight (Kg)	Percent Paper (incl. card-board)	Percent Ferrous Metals	Percent Non-Ferrous Metals	Percent Wood	Percent Plastic (incl. foam)	Percent Other
Refrigerators							
under 6.5 cu. ft							
6.5 - 12.4 cu. ft.							
12.5 - 16.4 cu. ft.							
16.5 - 19.4 cu. ft							
19.5 - 22.4 cu. ft							
22.5 cu. ft. and over							
Freezers							
Chest							
Upright							
Dishwashers							
Portable							
Built-in							
Clothes Washers							
Full Size							
Compact							
Clothes Dryers							
Full Size							
Compact							
Ranges							
24"							
30" Manual Clean							
30" Self Clean							

We will be surveying retailers to determine what there policies are on the removal and disposal of packaging. To help us determine the market share of the different types of retailer, we would like you to estimate the proportion of market represented by small, medium and large retailers in 2002.

	Percent Small Retailers	Percent Medium Retailers	Percent Large Retailers				
Refrigerators							
under 6.5 cu. ft							
6.5 - 12.4 cu. ft.							
12.5 - 16.4 cu. ft.							
16.5 - 19.4 cu. ft							
19.5 - 22.4 cu. ft							
22.5 cu. ft. and over							

Freezers							
Chest							
Upright							
Dishwashers							
Portable							
Built-in							
Clothes Washers							
Full Size							
Compact							
Clothes Dryers							
Full Size							
Compact							
Ranges							
24"							
30" Manual Clean							
30" Self Clean							

4. Other Comments

With your knowledge of the industry, you may be aware of other areas which we should take into consideration for this study. We would welcome any further comments that you could make.

Your Comments:

`

`

May we contact you by phone to follow up on these questions?

Yes No

Contact Phone #:

Thank you very much for participating in this study. We greatly appreciate your time and effort.

Your completed survey can be emailed to: cainger@electrofed.com or faxed to (416)221-6787
If possible, please respond by August 1, 2003.

APPENDIX B: Municipal Survey

INTRODUCTION

The Canadian Appliance Manufacturers Association (CAMA) in conjunction with the Natural Resources Canada (NRCan) is participating in a “Project to Establish Baseline Data and Tracking System for the Generation and Diversion of Obsolete White Goods from Residential Sources in Canada." One of the objectives of this study is to develop baseline figures for the number of major appliances sold, reused, recycled, stored and disposed each year in Canada. The study will also take into account the amount of packaging associated with white goods.

Hanson Research + Communications (HRC) And Hilkene International Policy have been retained to coordinate the study and conduct this national survey of municipalities to identify local white goods management policies and estimated quantities disposed and recovered.

We are requesting your municipality's cooperation in helping establish this important baseline information. The final report, to be completed by the end of November 2003 will be publicly available on the Internet and will include information on municipal, retail and industrial infrastructure for end-of-life white goods management as well as estimated regional recovery rates, and identification of environmental issues.

Please complete the sections below and return by email to jhanson@hansonresearch.ca or by fax to 613-761-7671 by Friday, October 3, 2003

Please note, for the purposes of this study "White Goods" are defined to include refrigerators, freezers, dishwashers, clothes washers, clothes dryers and ranges. Thank you in advance for participating in this survey. A copy of the final report will be made available in the new year. If you have any questions please contact John Hanson at **jhanson@hansonresearch.ca** or by phone at **613-761-7136**

MUNICIPAL SURVEY

1 Name:

2 Title:

3 Municipality:

4 Population:

5 Number of Households:

6 **Province:**

7 **Phone #:**

8 **Fax #:**

9 **Email:**

10 **Municipal Curbside Recycling?**

☐ YES

11 **Depot Recycling?**

☐ YES

12 **Does your municipality collect white goods for reuse or recycling?**

☐ YES

13 **Does your municipality collect white goods for disposal only? Y/N (If no, proceed to question 19.**

☐ YES

14 **In what year did your municipality start collecting white goods for reuse or recycling?**

15 **Indicate materials accepted:**

a) ☐ Refrigeartors
b) ☐ Freezers
c) ☐ Dishwashers
d) ☐ Washers
e) ☐ Dryers
f) ☐ Ranges

16 **What collection mechanisms are used?**

a) ☐ Curbside pick-up with regular garbage collection
b) ☐ Curbside pick-up on special collection day(s)

c) ☐ Curbside pick-up by special arrangement
d) ☐ Drop off at waste transfer site
e) ☐ Drop off at landfill site
f) ☐ Drop off at permanent recycling opr hazardous waste depot
g) ☐ Drop off at temporary recycling site and/or hazardous waste depot
h) ☐ Sorted from mixed waste stream
i) ☐ Partnering with retailer take-back program

17 Describe collection system (e.g. days and hours of operation, retail location, etc.):

18 What if any restrictions apply to materials collected?

19 Are you aware of private sector companies in your municipality that are running independent white goods collection programs?

☐ YES

20 If yes to question 19, please specify:

21 Do you keep records of amounts recovered?

☐ YES

22 For which year is most recent data available?

23 If yes to question 21, please specify by appropriate unit of measurement:

Units: _____
Kilograms _____
Pounds _____

24 If no to question 21, can you estimate quantities/amount recovered in:

Units: _____
Kilograms _____
Pounds _____

25 Are there components of white goods that are recovered which must be removed for disposal prior to recycling or reuse (e.g. ozone depleting substances)?

☐ YES

26 If yes to question 25, please specify:

27 To whom are your white goods shipped for processing or resale?

28 Contact information for contractor or end market:

Company:	
Contact:	
Street:	
Town/City:	
Postal Code:	
Phone:	
Fax:	

29 How does your municipality manage the white goods it collects?

- ☐ Sell to a recycler
- ☐ Give to a recycler
- ☐ Pay a recycler
- ☐ Donate to a second-hand reseller or charity
- ☐ Sell to a second hand reseller or charity
- ☐ Send to landfill

30 Estimate any revenue received for white goods collected:

31 Can you estimate the costs of operating your white goods collection program for?

Promotion & Ediucation	
Coordination	
Depot/special day staffing	
Contractor fees	
Transportation to market	
***OR** Combined cost of all*	

APPENDIX C: List Of Municipal Programs Participating In Survey

Columbia Shuswap Regional District	British Columbia
City of Chilliwack	British Columbia
Regional District of East Kootenay	British Columbia
Regional District of Kootenay Boundary	British Columbia
Greater Vancouver Regional District	British Columbia
Regional District of Central Kootenay	British Columbia
Thompson-Nicola Regional District	British Columbia
Regional District Fraser Fort George (Prince George)	British Columbia
Regional District of Kitimat-Stikine	British Columbia
Capital Regional District (Victoria, BC)	British Columbia
Skeena Queen Charlotte Regional District	British Columbia
County of Lethbridge	Alberta
Town of Banff	Alberta
Municipal District of Peace No.135	Alberta
Town of Peace River	Alberta
City of Cold Lake	Alberta
City of Leduc	Alberta
City of Calgary	Alberta
City of Edmonton	Alberta
City of Red Deer	Alberta
City of Camrose	Alberta
Town of Black Diamond	Alberta
City of Lloydminster	Alberta/Sask
City of Saskatoon	Saskatchewan
City of North Battleford	Saskatchewan
City of Swift Current	Saskatchewan
City of Regina	Saskatchewan
Town of Nipawin	Saskatchewan
City of Winnipeg	Manitoba
City of Selkirk	Manitoba
City of Brandon	Manitoba
City of Portage la Prairie	Manitoba
The Regional Municipality of Halton	Ontario
Region of Waterloo	Ontario
Regional Municipality of Niagara	Ontario
City of Hamilton	Ontario
City of Barrie	Ontario
City of North Bay	Ontario
Cit of Windsor	Ontario
Regional Municipality of Peel	Ontario
Region of Durham	Ontario
City of Guelph	Ontario
City of Owen Sound	Ontario

City of Orillia	Ontario
City of London	Ontario
Township of Minden Hills, Halilburton County	Ontario
City of Greater Sudbury	Ontario
Town of Minto	Ontario
Township of Rideau Lakes	Ontario
Town of Markham	Ontario
City of Toronto	Ontario
City of Kawartha Lakes	Ontario
Township of Carling	Ontario
Township of South Dundas	Ontario
City of Cornwall	Ontario
City of Ottawa	Ontatio
City of Montreal	Quebec
City of Laval	Quebec
City of Sherbrooke	Quebec
Village of Grand Manan	New Brunswick
Fredericton Region Solid Waste Commission	New Brunswick
Municipality of the District of West Hants	Nova Scotia
City of Yarmouth	Nova Scotia
Municipality of Argyle	Nova Scotia
Municipality of Clare	Nova Scotia
Town of Digby	Nova Scotia
Municipality of the District of Lunenburg	Nova Scotia
Annapolis Valley (Valley Waste Mgt)	Nova Scotia
Municipality of Colchester	Nova Scotia
Halifax Regional Municipality	Nova Scotia
City of Corner Brook	Newfoundland
Town of Gander	Newfoundland
City of St. John's	Newfoundland
Island Waste Management Corporation	Prince Edward Island

APPENDIX D: Retailer Survey

CANADIAN APPLIANCE MANUFACTURERS ASSOCIATION

NATIONAL WHITE GOODS RECOVERY SURVEY

INTRODUCTION

The Canadian Appliance Manufacturers Association (CAMA) in conjunction with the Natural Resources Canada (NRCan) is participating in a "Project to Establish Baseline Data and Tracking System for the Generation and Diversion of Obsolete White Goods from Residential Sources in Canada." One of the objectives of this study is to develop baseline figures for the number of major appliances sold, reused, recycled, stored and disposed each year in Canada. The study will also take into account the amount of packaging associated with white goods.

Hanson Research + Communications (HRC) And Hilkene International Policy have been retained to coordinate the study and conduct this national survey of retailers to identify local white goods management policies and estimated quantities disposed and recovered. The following survey will complement similar surveys of Canadian municipalities and white goods manufacturers.

We are requesting your company's cooperation in helping establish this important baseline information. The final report will be available early in the new year and will include information on municipal, retail and industrial infrastructure for end-of-life white goods management as well as estimated regional recovery rates, and identification of environmental issues.

Please complete the sections below and return by email to jhanson@hansonresearch.ca or by fax to 613-761-7671 by Friday, December 12, 2003.

Please note, company data submitted will be kept strictly confidential and will be released only in aggregate form for various regions of the country. For the purposes of this study "White Goods" are defined to include refrigerators, freezers, dishwashers, clothes washers, clothes dryers and ranges. Thank you in advance for participating in this survey. If you have any questions please contact John Hanson at jhanson@hansonresearch.ca or by phone at 613-761-7136.

I. SURVEY COMPLETED BY:

1 Name:

_____

2 Title:

_____

3 Company

_____

7 Phone:

_____

9 Fax:

_____

8 E-mail:

II. COMPANY PROFILE

9 How would you classify your company?

- ☐ Large Company (annual sales >$500 million)
- ☐ Mid-size company (annual sales $10 - 500 million)
- ☐ Small company (annual sales <$10 million)

10 Please select the range which most accurately represents the number of large appliances your company sells annually.

- ○ >1,000,000
- ○ 500,000 - 1,000,000
- ○ 100,000 - 500,000
- ○ 50,000 - 100,000
- ○ <50,000

11 Please indicate the number of store locations in each province.

Province	# of stores
BC	
AB	
SK	
MB	
ON	
PQ	
NB	
NS	
PEI	
NFD	
3 Territories	

III. WHITE GOODS/APPLIANCES

12 Please indicate the product categories sold in your stores.

- ☐ Refrigerators
- ☐ Freezers
- ☐ Ranges
- ☐ Clothes washers
- ☐ Clothes Dryers
- ☐ Dishwashers
- ☐ All of the above

13 Please check the policies that apply regarding take-back of old appliances when new ones are delivered.

a) ☐ Take back customer's old appliance when new one is delivered at no charge

b) ☐ Take back customer's old appliance when new one is delivered with a service fee

c) ☐ Transport the old unit to the curbside for municipal collection if requested

d) ☐ Same as (b), but take back fees vary according to the level of service provided and/or negotiable at the time of sale

e) ☐ Take back policies vary by region

14 If the answer to question 13 is c), please provide details of service levels (including service fees charged) and estimates of consumer preference.

15 If the answer to question 13 is (d), please indicate the more predominant policy between options a) b) or c) cited in question 13 on a province-by-province basis? (please check the appropriate option in the table below).

Province	Option (a)	Option (b)	Option (c)
BC			
AB			

SK			
MB			
ON			
PQ			
NB			
NS			
PEI			
NFD			
3 Territories			

16 Additional comments on old appliance take back policies.

17 Does your company sell new major appliances through catalog sales, the internet or other promotional means for pick-up at a third party delivery location (E.g. in rural or remote communities)?

☑ YES

18 If yes to question 17, do you have any policies regarding end-of-life management of the product or packaging?

19 How do your stores manage the white goods they collect?

☐ Sell to a recycler

☐ Sell for reconditioning or resale in a second hand market

☐ Give to a recycler

☐ Pay a recycler

☐ Donate to a secondhand reseller or charity

☐ Send to landfill

☐ Varies by region

Please specify:

20 Do you receive revenue for white goods collected? ☐ YES

Can you estimate revenue on an aggregate, per/tonne or per unit basis?

21 If recovered white goods are shipped for processing or resale, where are they generally sent? (please provide contact information for contractor or end market as applicable).

Company: _____

Contact Name: _____

Street: _____

Town/City: _____

Province: _____

Postal Code: _____

Phone : _____

Fax : _____

22 Has your company identified the gross and/or net costs of operating a white goods take back program? Please specify.

23 Does your company sponsor any municipal or third party white goods recovery initiatives? ☐ YES

If yes, please specify.

IV. PACKAGING

24 What is your company's policy regarding packaging associated with the home delivery of large appliances?

- (●) Customary to take away after uncrating
- ( ) Customary to leave behind
- ( ) Remove on customer's request
- ( ) Remove for a fee — Please specify:
- ( ) varies by region — Please specify:
- ( ) Other — Please specify:

25 How is that packaging managed in different regions of the country?

- [ ] Always recycled
- [ ] Recycled in those jurisdictions where market allow — Please specify:
- [ ] Depends on the material — Please specify:
- [ ] Don't know

26 Using this chart please indicate where possible the amount of packaging materials that are removed from a customer's premises as part of your delivery and uncrating of new appliances. (in kilograms)

	Old Corrugated Cardboard	Wood	Poly-styrene foam	Plastic shrink wrap	Other (Eg. Strapping)
BC					
AB					
SK					
MB					
ON					
PQ					
NB					
NS					
PEI					
NFD					
3 Territories					

APPENDIX E: Survey Questions for Second Hand Appliance Resellers

1. Most common supplier of used appliances
2. Other suppliers of appliances
3. Do they commonly receive from municipalities
4. From apartment building managers
5. From other
6. Much competition?
7. Most common type of appliances
8. Average age
9. Quantity received per year
10. Any estimate of size of the reused appliance market in your province? In Canada?
11. Any association representing appliance resellers
12. Are most independents or are their 2nd hand chains?
13. Who are the largest appliance resellers
14. How do you commonly dispose of non-functioning units… sell to recycler?
15. Name and contact of recycler
16. Average sale price of a 2nd hand stove, fridge, washer, drier, freezer, dishwasher
17. Does company usually get second appliances for free or does it pay
18. Is the company competing for appliances with scrap metal dealers
19. Is parts recovery and resale (for repair) part of the business? How big roughly?
20. Other comments

APPENDIX F: List Of Second Hand Appliance Resellers Contacted

The following national database of 227 appliance resellers was compiled for the survey from yellow pages across Canada

Josma Appliance Service
Au Grenier De Grand Mère M & R New & Used
Coin des Appareils Ménagers Usagés (Le)
Honest Boy Discounts
Frank's Appliance
Beau Bon Pas Cher Langlois Maurice
Bazar Masson
A & H Buy & Sell Used Appliances
Ameublement Bélanger Enr
Ameublement Delorimier
Ameublement Place à Téqui
Appliance Heaven
Appliance Plus Centre
Bulldog Appliances
Electro Usagés A1
Gold's Used Appliances Ltd
Mozart Réfrigération Inc
Niagara Regional Appliance Repair
Ontario Appliance Repair Service
Peterborough Appliances
R P Service Electroménagers Enr
Sam's Appliances
Spadoni's Northern Resale Outlet
A & R Appliances Ltd
A & T Furniture & Appliances
A K Home Appliances
A-Tech Appliance
AA Major Appliances
ABC Appliance Service
Able Appliance & Refrigeration Service
Accord Refrigeration & Appliance Service
Ace Appliance
Ace Appliance Sales & Service Ltd
Acores Appliances
Action Raymond Inc
Addison Used Appliances Ltd
Advanced Electronics
Al's Appliance
Al's Appliance - Sales
Alf Steffler Ltd
All Appliances & Electronics
All Appliances & Refrigeration
All Star Appliances
All-Temp Refrigeration
Ameublement Delorimier
Ameublement des Forges
Ameublement Frontenac
Anderson's Appliance Service
Appareils Electro Ménagers 341
Appareils Ménagers Cobra Enr
Appareils Ménagers Du Parc
Appareils Ménagers Econopro
Appareils Ménagers G N L
Appareils Ménagers Jarry
Appareils Ménagers Verdun
Appareils Ménagés Usagés Roger Lalonde
Appliance All Service
Appliance All Service
Appliance Boutique
Appliance Depot
Appliance Doctor
Appliance Doctor Ltd
Appliance Doctor
Appliance Express
Appliance Recycling Depot-Ottawa-Carleton
Appliance Solutions Ltd
Appliance Specialist
Appliance Warehouse
Appliance Warehouse Inc
Appliance World
Appliances Outlet
Arthur's Repairs
Aubaines Royal
B-Line Appliance Recycling Ltd
Barbie's Bargains & Variety
Barway Sales & Service Ltd
Belgrave & Sons Refrigeration S
Big Ed's Furniture And Consignment House Ltd
Bond's Appliance Works
Breck Home Furnishing & Appliance
Brown's Appliance Repair
Burnaby Vacuums
Byron Used Appliances
C & V Appliances No. 2
Canada Aide Internationale
Capital Appliances
Card's Appliances
Cascade Appliance Limited
Cedar Springs Sales Yard
Centre De Liquidation 727
Centre Économique D'Appareils Ménagers
Chez André Meubles Usagés
Classic Appliance
Coin des Trouvailles (Au)
Complete Appliance Service Ltd
Comptoir Familial de Terrebonne
Corbeil Electromenagers
Country Villa
Coxwell Appliance & Air Conditioning Service
Crystal Appliance
Delhi Buy & Sell Centre
Dependable Used Appliances
Dial-An-Appliance Service
Don's Appliances Inc
Drapeau Victor Enr
Eastend Second Hand Store
Easy Save Appliance Ltd
Economie Familiale
Ed's Appliances
Electro St-Amand
Electro Usagés Plus
Electro-Econo J S
Electro-Service Enr
Electro-Tech 2000
Electromenagers J D
Elite Delivery
Elite Delivery
Estate Quality Used Appliances & Furniture
Excell Appliances
Faucher Claude le Roi des Bas Prix
General Appliance Centre
Georgian Bay Home & Appliance Centre
Georgian Bay Refrigeration And Appliances
Gord's Other Store
Great Eastern Furniture And Appliances
Génie Du Confort Inc (Le)
Haighs Used Appliances

Handy Appliance Service Centre Ltd
Hank's Appliances Inc
Home Appliance Service
Ilac Service Co Ltd
Interior Appliance Service Ltd
Iron Bed The
J P N Enr
J. C. Appliances
Johnny's Appliance
K & A Appliance & Refrigeration Sales & Service
K M R Appliances
Kasey's Appliance
Keddy Burner & Electric Ltd
Kelly's Trading Company
KWA Used Appliances
L M Service
La Solution
Lacasse's Bargain Store
Langara Used Appliances
Lansdowne Appliance Ltd
Lansdowne Appliance Ltd
Larochelle Paul
Larry's New & Used Appliances
Les Trouvailles Du Brocanteur
Liquidation A T L
Liquidation St-Louis
Liquidations Stébenne
Liverpool Heating & Appliance Services Ltd
Lock City Repairs
Loxton Used Appliance Sales & Service
Major Appliances Plus
Malone's Appliance Centre
McFarland Appliances Ltd
Metrocity Appliances
Meubles Conseil Enr
Meubles Econo
Meubles St-Vallier
Meubles Usagés Billy
Multi Services Électro Ménagers
Mulvihill Appliance Service
Norton Used Appliances
Ocean Appliances Services
P L Electro Ménagers Usagés
P M Appareils Ménagers
P&D Used Appliances
Paul's Appliance Service
Peters Used Furniture & Appliances
Potter's Appliance Repairs
Pro-Tech Electroménagers
Queen East Appliance Centre
Queens Second Hand Store
R B S Used Furniture
R L Electroménager Inc
Ramsay Yvon
Recon Appliances
Recyclo-Centre
Refcon Appareils Ménagers Du Parc
ReUse Centre
Rexdale Appliances Ltd (1994)
Richard Service
Rod's Appliances
Roldan Services Inc
Rosco Appliances
Royal Appliancesales & Service Sudbury Limited
Réparations Martin & Fils Enr
S234 Appliances
Sam's Army Surplus
Second Choice Appliances
Secondhand Rose & Appliance Repair
Select Electro Meuble
Seniors Appliance Wholesale
Service Appareils Ménagers Ml Inc
Service d'Entretien Normand Matte Enr
Service Select enr
Shaugnessy Appliance Service
Slim's Industries Inc
SOS Electroménager
St Jean L & Used Appliances
Steel City Appliance Sales & Service Inc
Stout Richard Appliance
Summerside Clearance Centre
Super Appliances
Switzer's Furniture
T & D Appliance-Refrigeration
The Other Guy
Tiscia A M
TJ's Appliances
Tom's Used Appliances
Totem Appliance & Refrigeration Ltd
Uncle Toms Cabin
Used Appliance Gallery
Ward's Furniture & Appliances
West York Appliances & Furniture Sales & Serv
Westcoast Appliance
White Ed Appliance Service
Wholesale Major Used Appliances
Wyse Buys Trading Inc

APPENDIX G: Scrap Metal Businesses in Canada Handling White Goods Survey

INTRODUCTION

The Canadian Appliance Manufacturers Association (CAMA) in conjunction with the Natural Resources Canada (NRCan) is participating in a “Project to Establish Baseline Data and Tracking System for the Generation and Diversion of Obsolete White Goods from Residential Sources in Canada." One of the objectives of this study is to develop baseline figures for the number of major appliances sold, reused, recycled, stored and disposed each year in Canada.

Hanson Research + Communications (HRC) And Hilkene International Policy have been retained to coordinate the study and conduct this national survey of the scrap metal industry to identify local infrastructure and estimated quantities recovered.

We are requesting your cooperation in helping establish this important baseline information. The final report, to be completed by the end of April 2004 will be publicly available on the Internet and will include information on municipal, retail and industrial infrastructure for end-of-life white goods management as well as estimated regional recovery rates, and identification of environmental issues.

Please complete the sections below and return by email to chilkene@hilkene.com or by fax to 416. 425. 6667 as soon as possible.

Please note, for the purposes of this study "White Goods" are defined to include refrigerators, freezers, dishwashers, clothes washers, clothes dryers and ranges. Thank you in advance for participating in this survey. A copy of the final report will be made available later in the year. If you have any questions please contact Christopher Hilkene at chilkene@hilkene.com or by phone at 416-425-1313.

SCRAP METAL INDUSTRY SURVEY

Name:

Company:

Address:

Municipality:

Province:

Phone #:

Fax #:

Email:

1. Is your business a final end user of white goods (mill). Or do you process and bale/densify and ship to an end-user?

2. What is the approximate total weight of white goods you process?

3. What percentage of the scrap (by weight) you process would you estimate are white goods?

4. Approximately how many individual units do you receive per year (no air conditioners or water heaters)?

5. From whom do you get most of your supply (municipal governments, retailers, resellers/contractors, peddlers, residences etc.)?

6. Do you buy direct from the public?

7. Does the price of steel impact the quantity of white goods you process? Please explain.

8. Do you travel to pick up white goods? If so what is the maximum distance you will travel?

9. Do you have a sense of the size of the catchment area you serve?

10. What would be your minimum requirements?

11. Do you drain the CFCs prior to sending to recycling?

12. Do you remove parts prior to shipping for recycling? Is there a viable market for used parts from white goods?

13. In looking at the entire scrap market for white goods, where do the majority of end-of-life appliances end up?

APPENDIX H: Scrap Metal Businesses Contacted

The following business were identified for the survey from the Metals and Minerals Recycling Scan conducted for the Action Plan 2000 On Climate Change Enanced Recycling Committee in 2003.

Rainbow Salvage Ltd
Brooks Industrial Metals Ltd
Blackfoot Metals Ltd
Federal Metals Inc
IPSCO Direct Inc.
Navajo Metals
Altasteel Ltd
Maple Leaf Metal Industries
Penny Recycling Inc
Marshall Metals Scrap Recycling Ltd
Handy Man Used Bldg Materials
Cabin Fever
Harpers Metals Ltd
Porta Crush Ltd
GenAlta Recycling Inc.
Tim's Re-Usables
Proeco Enviroservices Ltd.
Ed Moritz Masonry & Tile Supply
Eric Etelamaki Holdings Ltd
ABC Recycling Ltd
Can Am Recycling 1992 Ltd.
Can-Am Recycling Ltd
Walker Scrap Metal
Columbia Recycle 1996 Ltd.(Genelle)
Kamloops Scrap Iron Ltd
North West Metal Recycling
Action Metals
Magna Enterprises
Fraser Valley Metal Exchange
Ridge Meadows Recycling Society
Columbia Recycle 1996 Ltd.(Marysville)
North Shore Recycling Program
Augusta Recyclers
Richmond Steel Recycling
Squamish Scrap Metals Ltd.
Amix Salvage & Sales Ltd
Budget Steel Ltd
Wastech Environmental Services
Action Salvage & Recycling
Hi-Rise Salvage Ltd.
Carney's Waste Systems
B-Line Appliance Recycling
AAA Salvage
Wesman Salvage
B. Gerrard Scrap Metal
Chisick Metal Ltd
Western Scrap Metals Inc.
Assiniboine Appliance Service -
CMHA RE-STORE
Westman Recycling Council
Carberry & North Cypress Recycling Depot
Crystal City Recycling Depot
J K Appliance Repair Service
Pembina Valley Containers
BRS Appliance Repair Roblin
Swan River Scrap Metal
A J Vacuum & Appliance Repairs
Ace Recycling Inc
Miramachi City Scrap Metals
Sers et Metaux Recycle Limited
Central Salvage
C & C Enterprises Inc.
Newfoundland Recycling Ltd
Newco Metal & Auto Recycling Ltd.
Cabot Electronics
Downeys Auto Ltd
Auto Sales and Haulage
Andy's Towing and Wrecking
Barrie Metals
Bray's Auto & Metal Recycling
Tiffin Recycling
Crawford Metal Corp
All Ontario Recycling
Capital Iron & Metal
Brantford Iron & Metal Co
Crusher Mobile Crane
Taft's Auto Parts and Recycling Inc.
Burlington Scrap & Rubbish Pick-up
ABC Metal Recycling Corp.
Newmarket Iron Metal & Auto
Mobile Iron Metal Inc
Medagh Industrial Supplies Ltd
Gerdau Ameristeel Recycling
Advance Auto Parts and Salvage
A & P Auto Wrecking
Northern Waste Transfer Services Ltd.
Ben-Met Steel & Metal Inc
Guelph Suburban Metals Ltd
Hagersville Recycling
Flamboro Iron & Metal
Poscor
Posner Metals Ltd
Premier Waste Systems Ltd.
Wentworth Metal Recycling
Wentworth Metal Recycling
Ranger Wrecking Yard & Towing
H Jones Salvage
Hillsdale Iron & Metals
Arnold's Auto Wreckers (1986) Ltd.
Kingsville Auto and Metal Recycling
Sel Recycling
Logel's Enterprises
Zubick John Ltd.
Worldwide Metal Brokers
Simcoe Waste Management Facl
Co-Steel Recycling
Blu Box
Moffatt Scrap Iron & Metal Inc.
Dundee Recycling Ltd
V8 Performance and Recycling
Fern Piche & Sons Ltd.
North Bay Salvage
Piche Fern & Sons Limited
G & R Automotive Machine Shop
Francoz Iron & Metal Inc.
P Schachter & Sons Ltd
Conroy Auto-Parts Recycling
Newcastle Recycling Ltd
Gerdau Ameristeel Recycling Cedardale
Bakermet Inc.
Billy's Appliances
K & D Salvage Ltd.
S.H. Masters & Son
B & A Recycling Metal
Mike's Salvage
King's Auto Parts/Wrecking
Harold Parrish Trucking
Wakely R & Sons Ltd.

Flesherton Auto Recyclers
Inc.
Niagara Auto Parts
Andre's Auto Recyclers
King Wm & Son Salvage
Algoma Steel Inc.
Triple M Metals
Adelstein Sam and Co.
Limited
Ernie's Scrap Metals Ltd
P J Metals
Leon & Sons Metal Ltd
Sudbury Iron & Copper Ltd
LaRue's Waste & Recycling
Dutchak Recycle Inc.
Lakehead Scrap Metals
Combined Metal Industries
Cooper's Iron & Metal Inc
Goodwill Industries Of
Toronto
High Park Scrap Metals
Solway G & Sons
Teperman Scrap Metal
Turtle Island Recyling Co
Meretty Salvage
Tweed Salvage Co
Recycling Specialists Inc.
Uxbridge Auto Wreckers
Andy's Country Repairs
South Shore International
Art's Auto Wreckers
Gerdau Ameristeel Recycling
Recycling Don Kitching
B Bros Metal
Ontario Iron & Metal co,
Muskoka Containerized Svc
Ltd
Capital Environmental
Resources
Sandhill Disposal & Recycling
Kimco Steel Sales Ltd
South Buxton Recycling Ltd
Cohen & Cohen
Palmer Recycling Ltd.
R & A Recyclers Inc.
Charlottetown Bottle & Metals
Ltd
A. Appell
Silverstar Salvage
Mc Donald Metals
B N Steel & Metal 2002 inc
Great Northern Salvage
Used Appliance Centre
Steel Services
Red Coat Waste Resource
Border Radio & TV Service
S & A Contracting
RM of Meota (WYWRA)
City of Moose Jaw
Lister Excavating &
Demolition
Town of Outlook
Town of Qu'Appelle
Habitat Restore
Re-Appliable Parts Inc
City Electronic Repairs
T W Handyman's Haven
Tricom Electronics (1998)
Ltd.
Red Coat Regional Waste
Authority
General Waste Management

APPENDIX I: Material Flows from White Goods by Year and Product Category

Sales and New Material entering the market						
SUMMARY	**2002 Tonnage**	**2003 Tonnage**	**2004 Tonnage**	**2005 Tonnage**	**2006 Tonnage**	**2007 Tonnage**
Annual Shipments (thousand units)	**2802.0**	**2766.0**	**2850.0**	**2846.0**	**2935.0**	**2892.0**
Total Weight (tonnes)	**209487.2**	**210553.5**	**218971.0**	**212901.2**	**216543.3**	**206542.6**
	Total Waste (in tonnes)	**Total Waste (in tonnes)**	**Total Waste (in tonnes)**	**Total Waste (in tonnes)**	**Total Waste (in tonnes)**	**Total Waste (in tonnes)**
Steel	133352.8	133572.2	137565.1	133703.3	136529.0	130748.0
Iron	6799.2	7092.3	7629.6	7312.8	7375.5	6921.6
Sub-Total: Ferrous Metal	**140152.0**	**140664.4**	**145194.8**	**141016.1**	**143904.5**	**137669.5**
Aluminum	7756.6	7507.5	7798.8	7855.1	8008.1	7424.9
Copper	6879.8	6913.8	7223.6	7072.5	7149.0	6739.7
Brass	271.2	267.2	284.4	285.6	282.7	286.2
Other Metal	2042.2	2052.1	1993.0	1862.2	1960.8	1914.7
Sub Total: Non-Ferrous Metal	**16949.9**	**16740.6**	**17299.9**	**17075.4**	**17400.6**	**16365.5**
Rubber	1414.7	1328.9	1383.3	1422.6	1443.3	1315.2
Fiber & Paper	177.6	177.4	187.7	188.5	186.4	186.3
Polypropylene	12888.9	11652.6	11958.7	12719.2	12720.8	12174.2
PS&HIPS	5004.9	5592.6	6386.3	5989.5	5938.6	5582.0
ABS	3329.2	3734.3	4222.6	3953.7	3972.0	3726.8
PVC	**1724.6**	**1730.9**	**1872.2**	**1860.6**	**1832.3**	**1795.9**
Polyurethane	6850.9	7543.1	8459.8	7752.9	7641.6	7081.7
Other Plastics	3305.8	3631.5	4092.1	3834.9	3814.1	3574.1
Asst. Mixed Plastics	3256.3	3279.5	3471.1	3386.1	3409.4	3259.9
Sub Total: Plastic	**36360.6**	**37164.4**	**40462.8**	**39496.9**	**39328.8**	**37194.6**
Fiberglass	4875.7	4770.1	4577.5	4342.2	4589.5	4547.2
Glass	6060.6	6287.6	6440.7	5986.7	6202.7	6035.3
Sub Total: Glass	**10936.3**	**11057.8**	**11018.1**	**10328.9**	**10792.2**	**10582.4**
Refrigerant	127.5	138.8	152.6	139.0	137.5	127.2
Oil	431.9	426.8	452.6	448.8	458.5	407.8
Other Materials	0.0	0.0	0.0	0.0	0.0	0.0
Typically Removed	0.0	0.0	0.0	0.0	0.0	0.0
Before Processing	0.0	0.0	0.0	0.0	0.0	0.0
Sub Total: Materials Typically Removed Before Processing	559.4	565.6	605.2	587.8	596.0	535.0
Other	3134.1	2989.0	2995.5	2984.6	3095.1	2853.9
Total	**209684.6**	**210688.0**	**219147.2**	**213100.9**	**216747.0**	**206702.6**

ACKNOWLEDGEMENTS:
Appliance Content Information Courtesy of the Association of Home Appliance Manufacturers
Appliance Lifespan Information Courtesy of APPLIANCE Magazine
Appliance Shipment Information Courtesey of the Canadian Appliance Manufacturers Association. Electro-Federation Canada

Table 1. Composition of Top/Bottom Refrigerators							
Year		**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Based on shipments from year (average life span = 16 years)		**1986**	**1987**	**1988**	**1989**	**1990**	**1991**
# Annual shipments (thousand units)		508.9	563.7	624.0	576.3	574.4	550.5
Average weight per shipment (kg)		94.6	96.3	97.9	99.5	101.2	99.0
Total weight shipments (tonnes)		48143.6	54256.2	61092.2	57365.7	58121.1	54518.8
Year	**1997**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**
Ave. weight = 186.2 lbs	**% content**						
Steel	56.3	27104.9	30546.2	34394.9	32296.9	32722.2	30694.1
Iron	5.4	2599.8	2929.8	3299.0	3097.7	3138.5	2944.0
Sub total: Ferrous metal	**61.7**	**29704.6**	**33476.1**	**37693.9**	**35394.6**	**35860.7**	**33638.1**
Aluminum	2.5	1203.6	1356.4	1527.3	1434.1	1453.0	1363.0
Copper	3.2	1540.6	1736.2	1954.9	1835.7	1859.9	1744.6
Brass	0.2	96.3	108.5	122.2	114.7	116.2	109.0
Other Metal	0.3	144.4	162.8	183.3	172.1	174.4	163.6
Sub total: Non-ferrous metal	**6.2**	**2984.9**	**3363.9**	**3787.7**	**3556.7**	**3603.5**	**3380.2**
Rubber	0.2	96.3	108.5	122.2	114.7	116.2	109.0
Fiber & paper	0.1	48.1	54.3	61.1	57.4	58.1	54.5
Polypropylene	0.6	288.9	325.5	366.6	344.2	348.7	327.1
PS&HIPS	7.4	3562.6	4015.0	4520.8	4245.1	4301.0	4034.4
ABS	6	2888.6	3255.4	3665.5	3441.9	3487.3	3271.1
PVC	1.2	577.7	651.1	733.1	688.4	697.5	654.2
Polyurethane	6.6	3177.5	3580.9	4032.1	3786.1	3836.0	3598.2
Other Plastics	4.3	2070.2	2333.0	2627.0	2466.7	2499.2	2344.3
Asst. mixed plastics	1.7	818.4	922.4	1038.6	975.2	988.1	926.8
Sub total: Plastic	**27.8**	**13383.9**	**15083.2**	**16983.6**	**15947.7**	**16157.7**	**15156.2**
Fiberglass	0.1	48.1	54.3	61.1	57.4	58.1	54.5
Glass	3.4	1636.9	1844.7	2077.1	1950.4	1976.1	1853.6
Sub total: Glass	**3.5**	**1685.0**	**1899.0**	**2138.2**	**2007.8**	**2034.2**	**1908.2**
Refrigerant	0.1	48.1	54.3	61.1	57.4	58.1	54.5
Oil	0.2	96.3	108.5	122.2	114.7	116.2	109.0
Other materials typically removed before processing	0	0.0	0.0	0.0	0.0	0.0	0.0
Sub total: Materials typically removed before processing	**0.3**	**144.4**	**162.8**	**183.3**	**172.1**	**174.4**	**163.6**
Other	**0.1**	**48.1**	**54.3**	**61.1**	**57.4**	**58.1**	**54.5**
Total	**99.9**	**48095.5**	**54201.9**	**61031.1**	**57308.3**	**58062.9**	**54464.3**

ACKNOWLEDGEMENTS:
Appliance Content Information Courtesy of the Association of Home Appliance Manufacturers
Appliance Lifespan Information Courtesy of APPLIANCE Magazine
Appliance Shipment Information Courtesy of the Canadian Appliance Manufacturers Association, Electro-Federation Canada

Table 2. Composition of Side-Side Refrigerators							
Year		**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Based on shipments from year (average life span = 16 years)		**1986**	**1987**	**1988**	**1989**	**1990**	**1991**
# Annual shipments (thousand units)		66.1	78.3	105.0	97.7	89.6	81.5
Average weight per shipment (kg)		141.9	139.2	136.6	133.9	131.3	132.1
Total weight shipments (tonnes)		9380.4	10904.0	14337.2	13089.4	11769.2	10770.3
Year	**1997**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**
Ave. weight = 245.9 lbs	**% content**						
Steel	53.8	5046.6	5866.4	7713.4	7042.1	6331.8	5794.4
Iron	4.9	459.6	534.3	702.5	641.4	576.7	527.7
Sub total: Ferrous metal	**58.7**	**5506.3**	**6400.7**	**8415.9**	**7683.5**	**6908.5**	**6322.2**
Aluminum	2.6	243.9	283.5	372.8	340.3	306.0	280.0
Copper	2.7	253.3	294.4	387.1	353.4	317.8	290.8
Brass	0.1	9.4	10.9	14.3	13.1	11.8	10.8
Other Metal	0.4	37.5	43.6	57.3	52.4	47.1	43.1
Sub total: Non-ferrous metal	**5.8**	**544.1**	**632.4**	**831.6**	**759.2**	**682.6**	**624.7**
Rubber	0.4	37.5	43.6	57.3	52.4	47.1	43.1
Fiber & paper	0.2	18.8	21.8	28.7	26.2	23.5	21.5
Polypropylene	0.4	37.5	43.6	57.3	52.4	47.1	43.1
PS&HIPS	9.2	863.0	1003.2	1319.0	1204.2	1082.8	990.9
ABS	2.3	215.7	250.8	329.8	301.1	270.7	247.7
PVC	1.5	140.7	163.6	215.1	196.3	176.5	161.6
Polyurethane	9.5	891.1	1035.9	1362.0	1243.5	1118.1	1023.2
Other Plastics	4.5	422.1	490.7	645.2	589.0	529.6	484.7
Asst. mixed plastics	2.8	262.7	305.3	401.4	366.5	329.5	301.6
Sub total: Plastic	**30.2**	**2832.9**	**3293.0**	**4329.8**	**3953.0**	**3554.3**	**3252.6**
Fiberglass	0.2	18.8	21.8	28.7	26.2	23.5	21.5
Glass	4	375.2	436.2	573.5	523.6	470.8	430.8
Sub total: Glass	**4.2**	**394.0**	**458.0**	**602.2**	**549.8**	**494.3**	**452.4**
Refrigerant	0.1	9.4	10.9	14.3	13.1	11.8	10.8
Oil	0.1	9.4	10.9	14.3	13.1	11.8	10.8
Other materials typically removed before processing	0	0.0	0.0	0.0	0.0	0.0	0.0
Sub total: Materials typically removed before processing	**0.2**	**18.8**	**21.8**	**28.7**	**26.2**	**23.5**	**21.5**
Other	**0.4**	**37.5**	**43.6**	**57.3**	**52.4**	**47.1**	**43.1**
Total	**100.1**	**9389.7**	**10914.9**	**14351.5**	**13102.5**	**11780.9**	**10781.0**

ACKNOWLEDGEMENTS:
Appliance Content Information Courtesy of the Association of Home Appliance Manufacturers
Appliance Lifespan Information Courtesy of APPLIANCE Magazine
Appliance Shipment Information Courtesey of the Canadian Appliance Manufacturers Association, Electro-Federation Canada

Table 3. Composition of Freezers							
Year		**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Based on shipments from year (average life span = 11 years)		**1991**	**1992**	**1993**	**1994**	**1995**	**1996**
# Annual shipments (thousand units)		230.0	245.0	260.0	234.0	234.0	215.0
Average weight per shipment (kg)		76.1	75.1	74.2	73.2	72.2	72.0
Total weight shipments (tonnes)		17498.8	18404.3	19281.0	17127.7	16902.6	15473.6
Year	**1997**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**
Ave. weight = 124.6 lbs	**% content**						
Steel	65.4	11444.2	12036.4	12609.7	11201.5	11054.3	10119.7
Iron	5.9	1032.4	1085.9	1137.6	1010.5	997.3	912.9
Sub total: Ferrous metal	**71.3**	**12476.7**	**13122.3**	**13747.3**	**12212.1**	**12051.5**	**11032.7**
Aluminum	0.4	70.0	73.6	77.1	68.5	67.6	61.9
Copper	6.1	1067.4	1122.7	1176.1	1044.8	1031.1	943.9
Brass	0.1	17.5	18.4	19.3	17.1	16.9	15.5
Other Metal	0	0.0	0.0	0.0	0.0	0.0	0.0
Sub total: Non-ferrous metal	**6.6**	**1154.9**	**1214.7**	**1272.5**	**1130.4**	**1115.6**	**1021.3**
Rubber	0.1	17.5	18.4	19.3	17.1	16.9	15.5
Fiber & paper	0	0.0	0.0	0.0	0.0	0.0	0.0
Polypropylene	0	0.0	0.0	0.0	0.0	0.0	0.0
PS&HIPS	0.8	140.0	147.2	154.2	137.0	135.2	123.8
ABS	0.7	122.5	128.8	135.0	119.9	118.3	108.3
PVC	0.8	140.0	147.2	154.2	137.0	135.2	123.8
Polyurethane	15.9	2782.3	2926.3	3065.7	2723.3	2687.5	2460.3
Other Plastics	2.3	402.5	423.3	443.5	393.9	388.8	355.9
Asst. mixed plastics	0.7	122.5	128.8	135.0	119.9	118.3	108.3
Sub total: Plastic	**21.2**	**3709.8**	**3901.7**	**4087.6**	**3631.1**	**3583.3**	**3280.4**
Fiberglass	0.2	35.0	36.8	38.6	34.3	33.8	30.9
Glass	0	0.0	0.0	0.0	0.0	0.0	0.0
Sub total: Glass	**0.2**	**35.0**	**36.8**	**38.6**	**34.3**	**33.8**	**30.9**
Refrigerant	0.4	70.0	73.6	77.1	68.5	67.6	61.9
Oil	0.2	35.0	36.8	38.6	34.3	33.8	30.9
Other materials typically removed before processing	0	0.0	0.0	0.0	0.0	0.0	0.0
Sub total: Materials typically removed before processing	**0.6**	**105.0**	**110.4**	**115.7**	**102.8**	**101.4**	**92.8**
Other	**0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Total	**100**	**17498.8**	**18404.3**	**19281.0**	**17127.7**	**16902.6**	**15473.6**

ACKNOWLEDGEMENTS:
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Table 4. Composition of Dishwashers							
Year		**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Based on shipments from year (average life span = 8 years)		**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
# Annual shipments (thousand units)		393.0	338.0	358.0	415.0	414.0	463.0
Average weight per shipment (kg)		47.3	47.3	45.6	43.8	42.1	40.4
Total weight shipments (tonnes)		18590.5	15984.3	16313.6	18196.2	17439.4	18706.0
Year	**1997**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**
Ave. weight = 67.8 lbs	**% content**						
Steel	49.5	9202.3	7912.2	8075.2	9007.1	8632.5	9259.5
Iron	0	0.0	0.0	0.0	0.0	0.0	0.0
Sub total: Ferrous metal	**49.5**	**9202.3**	**7912.2**	**8075.2**	**9007.1**	**8632.5**	**9259.5**
Aluminum	4.5	836.6	719.3	734.1	818.8	784.8	841.8
Copper	3.4	632.1	543.5	554.7	618.7	592.9	636.0
Brass	0.6	111.5	95.9	97.9	109.2	104.6	112.2
Other Metal	0.5	93.0	79.9	81.6	91.0	87.2	93.5
Sub total: Non-ferrous metal	**9**	**1673.1**	**1438.6**	**1468.2**	**1637.7**	**1569.5**	**1683.5**
Rubber	1.4	260.3	223.8	228.4	254.7	244.2	261.9
Fiber & paper	0.3	55.8	48.0	48.9	54.6	52.3	56.1
Polypropylene	30.8	5725.9	4923.2	5024.6	5604.4	5371.3	5761.5
PS&HIPS	0	0.0	0.0	0.0	0.0	0.0	0.0
ABS	0	0.0	0.0	0.0	0.0	0.0	0.0
PVC	3.3	613.5	527.5	538.3	600.5	575.5	617.3
Polyurethane	0	0.0	0.0	0.0	0.0	0.0	0.0
Other Plastics	0.4	74.4	63.9	65.3	72.8	69.8	74.8
Asst. mixed plastics	2.9	539.1	463.5	473.1	527.7	505.7	542.5
Sub total: Plastic	**37.4**	**6952.8**	**5978.1**	**6101.3**	**6805.4**	**6522.3**	**6996.1**
Fiberglass	1.1	204.5	175.8	179.4	200.2	191.8	205.8
Glass	0	0.0	0.0	0.0	0.0	0.0	0.0
Sub total: Glass	**1.1**	**204.5**	**175.8**	**179.4**	**200.2**	**191.8**	**205.8**
Refrigerant	0	0.0	0.0	0.0	0.0	0.0	0.0
Oil	0	0.0	0.0	0.0	0.0	0.0	0.0
Other materials typically removed before processing	0	0.0	0.0	0.0	0.0	0.0	0.0
Sub total: Materials typically removed before processing	**0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Other	**1.3**	**241.7**	**207.8**	**212.1**	**236.6**	**226.7**	**243.2**
Total	**100**	**18590.5**	**15984.3**	**16313.6**	**18196.2**	**17439.4**	**18706.0**

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Table 5. Composition of Gas Ranges							
Year		**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Based on shipments from year (average life span = 14 years)		**1988**	**1989**	**1990**	**1991**	**1992**	**1993**
# Annual shipments (thousand units)		40.0	30.0	28.0	28.0	30.0	50.0
Average weight per shipment (kg)		75.7	74.8	73.9	75.1	76.4	77.6
Total weight shipments (tonnes)		3028.2	2244.2	2069.5	2103.7	2290.6	3878.8
Year	**1997**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**
Ave. weight = 178.1 lbs	**% content**						
Steel	83.9	2540.6	1882.9	1736.3	1765.0	1921.8	3254.3
Iron	3.5	106.0	78.5	72.4	73.6	80.2	135.8
Sub total: Ferrous metal	**87.4**	**2646.6**	**1961.4**	**1808.7**	**1838.6**	**2002.0**	**3390.0**
Aluminum	2.3	69.6	51.6	47.6	48.4	52.7	89.2
Copper	0.3	9.1	6.7	6.2	6.3	6.9	11.6
Brass	0.3	9.1	6.7	6.2	6.3	6.9	11.6
Other Metal	0	0.0	0.0	0.0	0.0	0.0	0.0
Sub total: Non-ferrous metal	**2.9**	**87.8**	**65.1**	**60.0**	**61.0**	**66.4**	**112.5**
Rubber	0	0.0	0.0	0.0	0.0	0.0	0.0
Fiber & paper	0	0.0	0.0	0.0	0.0	0.0	0.0
Polypropylene	0	0.0	0.0	0.0	0.0	0.0	0.0
PS&HIPS	0	0.0	0.0	0.0	0.0	0.0	0.0
ABS	0.2	6.1	4.5	4.1	4.2	4.6	7.8
PVC	0	0.0	0.0	0.0	0.0	0.0	0.0
Polyurethane	0	0.0	0.0	0.0	0.0	0.0	0.0
Other Plastics	0.4	12.1	9.0	8.3	8.4	9.2	15.5
Asst. mixed plastics	0.6	18.2	13.5	12.4	12.6	13.7	23.3
Sub total: Plastic	**1.2**	**36.3**	**26.9**	**24.8**	**25.2**	**27.5**	**46.5**
Fiberglass	6	181.7	134.7	124.2	126.2	137.4	232.7
Glass	5.1	154.4	114.5	105.5	107.3	116.8	197.8
Sub total: Glass	**11.1**	**336.1**	**249.1**	**229.7**	**233.5**	**254.3**	**430.5**
Refrigerant	0	0.0	0.0	0.0	0.0	0.0	0.0
Oil	0	0.0	0.0	0.0	0.0	0.0	0.0
Other materials typically removed before processing	0	0.0	0.0	0.0	0.0	0.0	0.0
Sub total: Materials typically removed before processing	**0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Other	**0.4**	**12.1**	**9.0**	**8.3**	**8.4**	**9.2**	**15.5**
Total	**103**	**3119.0**	**2311.5**	**2131.6**	**2166.8**	**2359.3**	**3995.1**

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Table 6. Composition of Electric Ranges							
Year		**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Based on shipments from year (average life span = 14 years)		**1988**	**1989**	**1990**	**1991**	**1992**	**1993**
# Annual shipments (thousand units)		527.0	520.0	486.0	457.0	497.0	494.0
Average weight per shipment (kg)		78.6	79.6	80.7	79.3	77.9	76.5
Total weight shipments (tonnes)		41425.8	41407.4	39197.0	36227.7	38713.0	37797.9
Year	**1997**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**
Ave. weight = 105.8 lbs	**% content**						
Steel	69.9	28956.6	28943.7	27398.7	25323.1	27060.4	26420.7
Iron	0.1	41.4	41.4	39.2	36.2	38.7	37.8
Sub total: Ferrous metal	**70**	**28998.1**	**28985.2**	**27437.9**	**25359.4**	**27099.1**	**26458.5**
Aluminum	1.4	580.0	579.7	548.8	507.2	542.0	529.2
Copper	0.7	290.0	289.9	274.4	253.6	271.0	264.6
Brass	0	0.0	0.0	0.0	0.0	0.0	0.0
Other Metal	4.2	1739.9	1739.1	1646.3	1521.6	1625.9	1587.5
Sub total: Non-ferrous metal	**6.3**	**2609.8**	**2608.7**	**2469.4**	**2282.3**	**2438.9**	**2381.3**
Rubber	0.1	41.4	41.4	39.2	36.2	38.7	37.8
Fiber & paper	0	0.0	0.0	0.0	0.0	0.0	0.0
Polypropylene	0.2	82.9	82.8	78.4	72.5	77.4	75.6
PS&HIPS	0	0.0	0.0	0.0	0.0	0.0	0.0
ABS	0.1	41.4	41.4	39.2	36.2	38.7	37.8
PVC	0	0.0	0.0	0.0	0.0	0.0	0.0
Polyurethane	0	0.0	0.0	0.0	0.0	0.0	0.0
Other Plastics	0.2	82.9	82.8	78.4	72.5	77.4	75.6
Asst. mixed plastics	1.7	704.2	703.9	666.3	615.9	658.1	642.6
Sub total: Plastic	**2.2**	**911.4**	**911.0**	**862.3**	**797.0**	**851.7**	**831.6**
Fiberglass	9	3728.3	3726.7	3527.7	3260.5	3484.2	3401.8
Glass	9.4	3894.0	3892.3	3684.5	3405.4	3639.0	3553.0
Sub total: Glass	**18.4**	**7622.3**	**7619.0**	**7212.2**	**6665.9**	**7123.2**	**6954.8**
Refrigerant	0	0.0	0.0	0.0	0.0	0.0	0.0
Oil	0	0.0	0.0	0.0	0.0	0.0	0.0
Other materials typically removed before processing	0	0.0	0.0	0.0	0.0	0.0	0.0
Sub total: Materials typically removed before processing	**0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Other	**2.7**	**1118.5**	**1118.0**	**1058.3**	**978.1**	**1045.3**	**1020.5**
Total	**99.7**	**41301.5**	**41283.1**	**39079.4**	**36119.0**	**38596.9**	**37684.5**

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Table 7. Composition of Clothes Washers							
Year		**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Based on shipments from year (average life span = 12 years)		**1990**	**1991**	**1992**	**1993**	**1994**	**1995**
# Annual shipments (thousand units)		554.0	522.0	552.0	582.0	614.0	533.0
Average weight per shipment (kg)		79.4	77.9	76.4	74.9	73.4	71.9
Total weight shipments (tonnes)		43967.5	40651.4	42166.6	43592.5	45076.1	38336.8
Year	**1997**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**
Ave. weight = 146.8 lbs	**% content**						
Steel	63	27699.5	25610.4	26564.9	27463.3	28397.9	24152.2
Iron	3.2	1407.0	1300.8	1349.3	1395.0	1442.4	1226.8
Sub total: Ferrous metal	**66.2**	**29106.5**	**26911.2**	**27914.3**	**28858.3**	**29840.4**	**25378.9**
Aluminum	8.5	3737.2	3455.4	3584.2	3705.4	3831.5	3258.6
Copper	3.9	1714.7	1585.4	1644.5	1700.1	1758.0	1495.1
Brass	0	0.0	0.0	0.0	0.0	0.0	0.0
Other Metal	0	0.0	0.0	0.0	0.0	0.0	0.0
Sub total: Non-ferrous metal	**12.4**	**5452.0**	**5040.8**	**5228.7**	**5405.5**	**5589.4**	**4753.8**
Rubber	2	879.3	813.0	843.3	871.9	901.5	766.7
Fiber & paper	0	0.0	0.0	0.0	0.0	0.0	0.0
Polypropylene	13.8	6067.5	5609.9	5819.0	6015.8	6220.5	5290.5
PS&HIPS	0	0.0	0.0	0.0	0.0	0.0	0.0
ABS	0	0.0	0.0	0.0	0.0	0.0	0.0
PVC	0.2	87.9	81.3	84.3	87.2	90.2	76.7
Polyurethane	0	0.0	0.0	0.0	0.0	0.0	0.0
Other Plastics	0.3	131.9	122.0	126.5	130.8	135.2	115.0
Asst. mixed plastics	1.3	571.6	528.5	548.2	566.7	586.0	498.4
Sub total: Plastic	**15.6**	**6858.9**	**6341.6**	**6578.0**	**6800.4**	**7031.9**	**5980.5**
Fiberglass	1	439.7	406.5	421.7	435.9	450.8	383.4
Glass	0	0.0	0.0	0.0	0.0	0.0	0.0
Sub total: Glass	**1**	**439.7**	**406.5**	**421.7**	**435.9**	**450.8**	**383.4**
Refrigerant	0	0.0	0.0	0.0	0.0	0.0	0.0
Oil	0.6	263.8	243.9	253.0	261.6	270.5	230.0
Other materials typically removed before processing	0	0.0	0.0	0.0	0.0	0.0	0.0
Sub total: Materials typically removed before processing	**0.6**	**263.8**	**243.9**	**253.0**	**261.6**	**270.5**	**230.0**
Other	**3.5**	**1538.9**	**1422.8**	**1475.8**	**1525.7**	**1577.7**	**1341.8**
Total	**101.3**	**44539.0**	**41179.8**	**42714.7**	**44159.2**	**45662.1**	**38835.1**

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Table 8. Composition of Clothes Dryers							
Year		**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Based on shipments from year (average life span = 13 years)		**1989**	**1990**	**1991**	**1992**	**1993**	**1994**
# Annual shipments (thousand units)		483.0	469.0	437.0	456.0	482.0	505.0
Average weight per shipment (kg)		56.8	56.9	56.1	55.3	54.4	53.6
Total weight shipments (tonnes)		27452.5	26701.7	24514.0	25198.2	26231.5	27060.5
Year	**1997**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**	**Total waste (tonnes)**
Ave. weight = 93.1 lbs	**% content**						
Steel	77.8	21358.0	20773.9	19071.9	19604.2	20408.1	21053.1
Iron	4.2	1153.0	1121.5	1029.6	1058.3	1101.7	1136.5
Sub total: Ferrous metal	**82**	**22511.0**	**21895.4**	**20101.5**	**20662.5**	**21509.8**	**22189.6**
Aluminum	3.7	1015.7	988.0	907.0	932.3	970.6	1001.2
Copper	5	1372.6	1335.1	1225.7	1259.9	1311.6	1353.0
Brass	0.1	27.5	26.7	24.5	25.2	26.2	27.1
Other Metal	0.1	27.5	26.7	24.5	25.2	26.2	27.1
Sub total: Non-ferrous metal	**8.9**	**2443.3**	**2376.4**	**2181.7**	**2242.6**	**2334.6**	**2408.4**
Rubber	0.3	82.4	80.1	73.5	75.6	78.7	81.2
Fiber & paper	0.2	54.9	53.4	49.0	50.4	52.5	54.1
Polypropylene	2.5	686.3	667.5	612.9	630.0	655.8	676.5
PS&HIPS	1.6	439.2	427.2	392.2	403.2	419.7	433.0
ABS	0.2	54.9	53.4	49.0	50.4	52.5	54.1
PVC	0.6	164.7	160.2	147.1	151.2	157.4	162.4
Polyurethane	0	0.0	0.0	0.0	0.0	0.0	0.0
Other Plastics	0.4	109.8	106.8	98.1	100.8	104.9	108.2
Asst. mixed plastics	0.8	219.6	213.6	196.1	201.6	209.9	216.5
Sub total: Plastic	**6.1**	**1674.6**	**1628.8**	**1495.4**	**1537.1**	**1600.1**	**1650.7**
Fiberglass	0.8	219.6	213.6	196.1	201.6	209.9	216.5
Glass	0	0.0	0.0	0.0	0.0	0.0	0.0
Sub total: Glass	**0.8**	**219.6**	**213.6**	**196.1**	**201.6**	**209.9**	**216.5**
Refrigerant	0	0.0	0.0	0.0	0.0	0.0	0.0
Oil	0.1	27.5	26.7	24.5	25.2	26.2	27.1
Other materials typically removed before processing	0	0.0	0.0	0.0	0.0	0.0	0.0
Sub total: Materials typically removed before processing	**0.1**	**27.5**	**26.7**	**24.5**	**25.2**	**26.2**	**27.1**
Other	**0.5**	**137.3**	**133.5**	**122.6**	**126.0**	**131.2**	**135.3**
Total	**98.9**	**27150.5**	**26407.9**	**24244.4**	**24921.0**	**25942.9**	**26762.9**

ACKNOWLEDGEMENTS:
Appliance Content Information Courtesy of the Association of Home Appliance Manufacturers
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Appliance Shipment Information Courtesey of the Canadian Appliance Manufacturers Association, Electro-Federation Canada