

Advisory

# *Major Appliance Recycling Roundtable*

## Study of Major Appliance Recycling

17 February 2017

**pwc**

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# *Executive Summary*

# *Economics of Recycling End of Life Appliances*

## Mandate

- You have asked us to perform a study that assesses the economic parameters underlying the collection and processing of end-of-life major appliances in British Columbia (“BC”). We understand that this study will be used by MARR to quantify, evaluate and analyze revenues and costs gained/incurred at each key segment of the process and to identify practices that would enhance the economics of this market.

## Methodology

- In assessing the economics of recycling end-of-life major appliances, we have identified the various key players and assessed their revenue and cost drivers. We have also performed an analysis of the financial sensitivity of the market to fluctuations of these cost drivers.
- The results of our analysis are summarized in the chart below.

Key Players	2015 Profit	Sensitivity <sup>1</sup> 2013 Profit	Sensitivity <sup>2</sup> External Inputs	Overall Findings
<b>Regional Districts</b>	(4,303,800)	(2,099,700)	(6,538,500)	Regional districts incur a loss on end-of-life major appliance recycling programs on a standalone basis, before consideration of the allocation of tax revenues. As can be seen from the 2013 analysis, higher metal prices could help reduce the losses incurred by regional districts.
<b>Retailers</b>	817,128	2,007,342	(5,932,872)	Our analysis excludes transportation costs on the basis that retailers typically collect end-of-life major appliances when they deliver new appliances; as such, the marginal transportation costs was assumed to be insignificant. We note that including transportation costs would result in a loss of \$1.6 million in 2015 (2013 - \$900,000).
<b>ODS Removers</b>	1,755,000	1,755,000	1,755,000	We estimate that before consideration of transportation costs, ODS removers earned a profit. The limited number of approved persons who can provide such services suggests that ODS removers are able to price their services in a profitable manner under any reasonable circumstances.
<b>Recyclers</b>	945,641	1,375,529	945,641	Recyclers are generally able to pass on the decline in metal prices to retailers and the regional districts by paying a lower fee for end-of-life appliances / scrap metal; as such, their ability to make a profit is not affected by metal prices, however the quantum of their profit can be affected by metal price movements.
<b>Total Profitability</b>	<b>(786,031)</b>	<b>3,038,171</b>	<b>(9,770,731)</b>	<b>Notes:</b> 1. Based on consideration of 2013 metal prices 2. Excluding external inputs such as tipping fees and pickup fees

# *Rural and Remote Communities Study – Current State*

## *Characteristics*

### **Network**

- Apparent absence of established dedicated routes and frequency
- Apparent absence of logistics contract management practices across the system (all regions, all areas)
- No centralized visibility: total absence of transportation management system with basic functionalities around asset planning and scheduling removal

### **Asset Traceability**

- There is no system in place to follow the asset life cycle during the end of life cycle. This may lead to revenue leakage and assets being transferred without economic-financial control

### **Asset Ownership**

- No real ownership on asset may lead to long removal cycle process and revenue leakage

# *Mandate*

# Regulatory Background

## Introduction

- Major household appliances are regulated under British Columbia's Recycling Regulation (the "Regulation").
- By creating these extended producer responsibilities, the Regulation is attempting to create efficiencies and raise awareness about producing items that don't harm the environment, reduce municipal waste disposal costs, and increase the volume of waste diverted from landfill.
- Under the Regulation, producers (e.g. manufacturers, retailers and first importers) are obliged to operate a stewardship program that manages the recycling of the products at their end-of-life. The Major Appliance Recycling Roundtable ("MARR") in British Columbia was created in 2012 as a response to the need for a stewardship program.

***PwC has been engaged to perform the following mandates:***

- 1. Assess the economic viability of the market driven system of collection and processing of end-of-life major appliances in British Columbia; and***
- 2. Perform a case study analyzing the challenges and barriers facing the transporting and processing of end-of-life appliances from rural and remote areas in British Columbia.***



# *Economics of Recycling End of Life Appliances*

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## **Background**

- Major household appliances have a financial value at the end of their life (“EoL appliances”) due to their significant metal component. This inherent value has created a market driven system of product collection and recycling which is not typical in many traditional stewardship programs. The major players in the market for EoL major appliances include collectors, consolidators and processors.
- In this context, you have asked us to perform a study that assesses the economic parameters underlying the collection and processing of EoL major appliances in British Columbia. We understand that this study will be used by MARR to quantify, evaluate and analyze revenues and costs gained/incurred at each key segment of the process and to identify practices that would enhance the economics of this market.

## **Methodology**

- In assessing the economics of recycling EoL major appliances, the key steps in our methodology are as follows:
  - Identifying which components/processes/activities generate costs and/or revenues for recycling major appliances for each type of market participant;
  - Identifying the costs and/or revenues for recycling major appliances by region type and the major drivers impacting those costs and revenues;
  - Identifying market failures and the region types in British Columbia where costs likely exceed the revenues for the recycling of major appliances; and
  - Performing an analysis on the financial sensitivity of the market to fluctuations in major cost and revenue drivers across region types (e.g. scrap metal commodity price).

# *Rural and Remote Communities Study*

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## **Background**

- We understand that there are unique challenges faced by rural and remote communities that may limit their participation in the market driven system for recycling EoL major appliances. Those challenges include lack of metal processors and long transportation distances to material markets. In this study we have collected data and analysed the negative impact of such barriers. We have also provided our insight into actions that may reduce the potential negative impact.
- Our study was conducted in four phases, as described opposite.

## **Methodology**

### **Phase 1: Demographic Analysis**

Determined criteria to be used in selecting the rural/remote communities and then defining those communities that will be incorporated into the study.

### **Phase 2: Surveying (Case Studies)**

Focused on the communities identified in phase 1 and surveying these communities on current practices and costs associated with the handling, decommissioning, transporting and processing of EoL appliances. Our research details the geographic and socio-economic differences between various rural and remote regions that are the source for the challenges and barriers of the rural/remote communities.

### **Phase 3: Transportation Mapping**

This phase involved mapping transportation routes from rural and remote communities to downstream processing and end markets.

### **Phase 4: Scenario Mapping and Impacts**

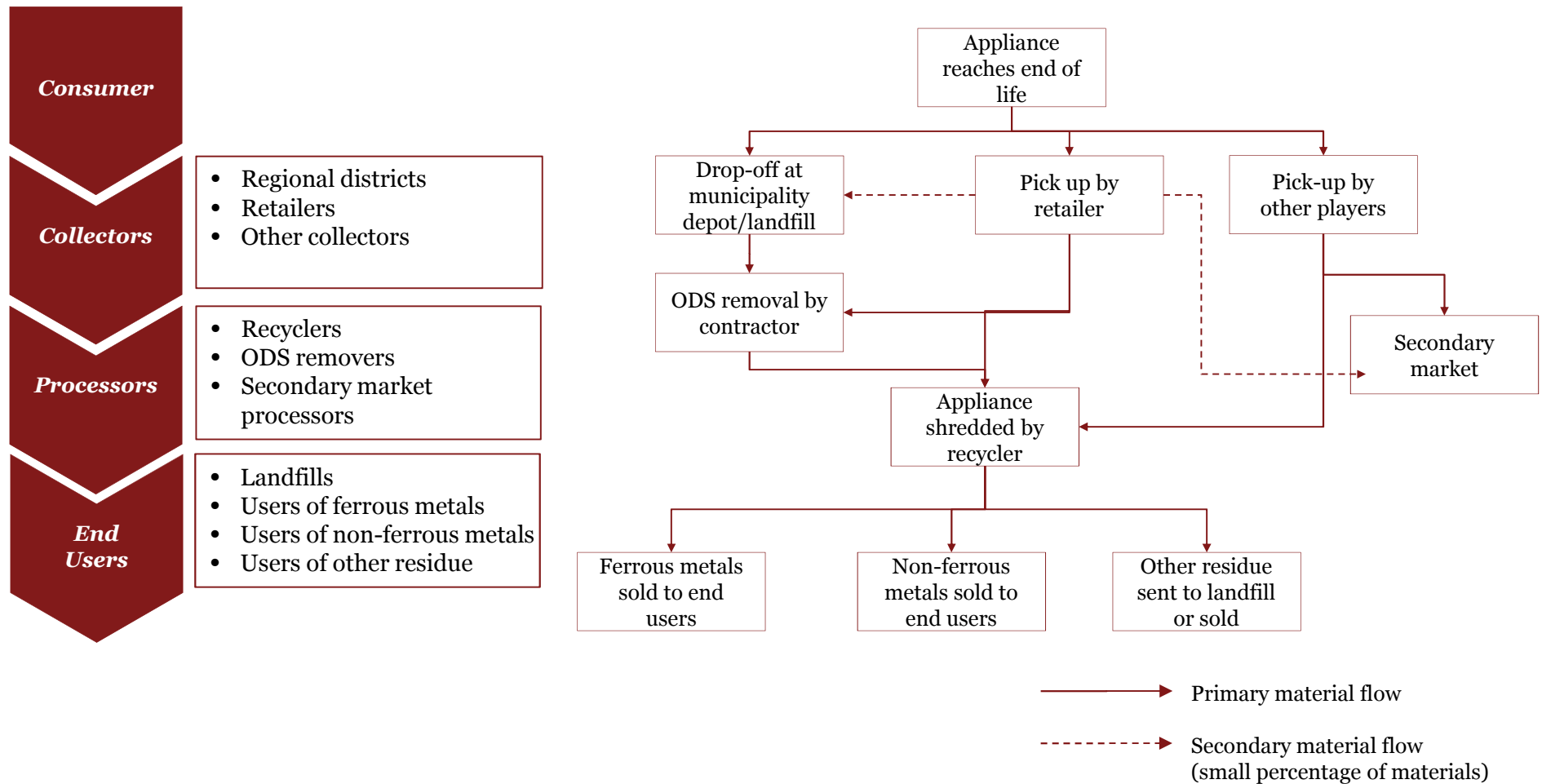
This phase involved the consolidation and analysis of the information obtained with respect to managing the removal and processing of end of life major appliances in the identified communities. The characteristics and impacts of such have been described in section 6 of this report.

## *Major Assumptions and Limitations*

- PwC relied upon the completeness, accuracy and fair presentation of all information, data, advice, opinions or representations obtained from various sources which were not audited or otherwise verified. These sources include:
  - Surveys of participants in the EoL appliance recycling process;
  - Industry data available from public sources, including MARR's website;
  - Publicly available studies and reports; and
  - Other publicly available data and information.
- The findings of our analysis are conditional upon such completeness, accuracy and fair presentation of the information, which has not been verified independently by PwC. Accordingly, we provide no opinion, attestation or other form of assurance with respect to the results of our analysis.
- Our analysis was limited by data availability and samples that did not adhere with common statistical practices. Thus, our estimations were based on extrapolation of relatively small samples and relied on various assumptions we made in order to bridge data gaps. Accordingly, the figures presented in this report should be seen as general high level indications. The true figures may deviate significantly from our estimations.
- PwC reserves the right, at its discretion to, withdraw or make revisions to this analysis should we be made aware of facts existing at the date of this analysis that were not known to us when we prepared this analysis. The findings are as of August 2016. PwC is under no obligation to advise any person of any change or matter brought to its attention after such date which would affect the findings, and PwC reserves the right to change or withdraw this analysis.
- This analysis has been prepared solely for the use and benefit of, and pursuant to a client relationship exclusively with, MARR. PwC disclaims any contractual or other responsibility to others based on its use and, accordingly, this information may not be relied upon by anyone other than MARR.
- Our report must be considered in its entirety by the reader, as selecting and relying on only specific portions of the analyses or factors considered by us, without considering all factors and analyses together, could create a misleading view of the processes underlying this analysis and the conclusions there from.
- Any use that a third party makes of this analysis or reliance thereon, or any decision made based on it, is the responsibility of such third party. PwC accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken, based on this analysis.

# *Background*

# Material Flow Role and Activity Diagram



# Material Flow

## Description of Key Players

### Consumers

- Once a major appliance has reached the end of its useful life, a consumer can dispose of the EoL appliance through a number of methods:
  - The EoL appliance can be dropped off at a municipal recycling depot, transfer station or landfill (collectively referred to as “collection sites”).
  - If the consumer has purchased a replacement appliance from a retailer, the retailer may offer appliance removal.
  - Other methods of disposing of EoL appliances include bounty programs, scavengers and utilities.

### Municipalities

- We understand that the responsibility for EoL appliances typically lies at the **regional district** level of the municipalities. Regional districts have set drop-off points (i.e. collection sites). Some regional districts charge a fee (typically referred to as a “tipping fee”) to cover their costs. This fee can differ depending on the type of EoL appliance (in particular, whether it contains an ozone depleting substance; abbreviated “ODS”). These facilities are either operated by the regional district or by a third-party contractor.
- The regional districts that we interviewed do not otherwise collect EoL appliances directly from consumers (for example, through a curb-side pickup). We understand that collecting major appliances is not a common practice for regional districts due to the high logistics/transportation cost involved.
- After receiving the EoL appliances, the regional districts will typically store appliances at warehouses or a landfill site. The regional district will then hire an ODS remover to remove ODS from EoL appliances which contain such substances. After removal, the EoL appliances, along with other scrap metal, are sold by the regional districts to recyclers.

### Retailers

- When a retailer sells a new appliance to a consumer, they will usually offer to pick up the consumer’s old appliance at the same time that they deliver the new one, typically on a one for one basis.
- Most retailers charge a “pick-up fee” to cover the cost of picking up and transporting the appliance to a recycling collection point. Some retailers will forego fees and offer the service for free, as a selling feature in the hope of enticing the consumer to purchase a replacement appliance from their store.
- Retailers may provide transportation themselves, or subcontract this service to a third party.
- For retailers who transport and sort appliances themselves, they may carry a number of EoL appliances at their warehouse, where they are separated by type (i.e. fridges, stoves, dishwashers). These retailers may hire an ODS remover to remove ODS from EoL appliances which contain such substances and send the EoL appliances to a recycler. Some recyclers will accept EoL appliances which contain ODS. Smaller retailers will drop EoL appliances off at a collection site and pay the associated tipping fee.
- We understand that some retailers will donate, or refurbish and resell, appliances which they collect. This could result in some revenues for the retailers, which have not been incorporated in our analysis.

### Other Collectors

- EoL appliances may also be recycled and/or otherwise disposed of through other channels; for example, refurbishers, scavengers, and certain not-for-profit environmental groups. These channels are beyond the scope of this engagement and make up a relatively small portion of the total tonnes recycled (approximately 8.3% based on MARR’s 2015 annual report).

# Material Flow

## Description of Key Players

### ODS Removers

- Environmental regulations in British Columbia require that at least 90% of the ODS contained in an EoL appliance be removed. Common examples of substances that fall under this regulation include refrigerants, insulating foams, mercury, and used oil.
- ODS regulations in British Columbia require that ODS removal be performed by approved persons, a term defined in Part 1 of B.C. Reg. 387/99. This role is referred to in our analysis as the “ODS remover”.
- The ODS remover will commonly charge a fee to the recycler or retailer/municipality for this service, and will dispose of the harmful substances. This usually entails giving them, free of charge, to a chemical company which can use the substances in chemical creation and recycling.

### Recyclers

- This is a broad category that includes all types of players that use/process material from EoL appliances.
- The primary recyclers are companies involved in scrap processing and consolidation, shredders, large scale balers, and steel smelters. These companies purchase EoL appliances and other scrap metal from regional districts and retailers.
- Given that major appliances are comprised of a number of different types of materials, EoL appliances are typically processed through a shredding process, as it is considered to be the most efficient process. The shredding process also segregates the materials.
- An alternate method to process EoL appliances is melting the crushed appliances. The residue materials are incinerated, leaving only the ferrous and non-ferrous metal.

- The resultant ferrous and non-ferrous metals are sold to end users. Other products, such as shredder residue (including plastic), are disposed of, typically in a landfill. There are some parts from major appliances (such as glass) which may have value, but we understand that whether such materials are processed and resold depends on the process by which the EoL appliances are delivered to the recycler and the recycler’s ability to process such materials.
- We understand that there are only a few recyclers remaining in British Columbia who process the metal in the province. Most recyclers have consolidated their operations, and send the scrap metal to facilities outside of the province (often in the United States) for shredding / additional processing.

### Landfills

- Shredder residue is typically disposed of in a landfill. Landfills in British Columbia are owned by the regional district or municipality in which landfills are located, and either operated by the regional district or subcontracted to a third party operator.
- Some landfills charge for disposal of shredder residue by weight of the material. In the past, shredder residue was accepted free of charge at landfills and used as landfill cover. Changing environmental regulations and best practices have resulted in this practice falling out of favour and, as such, shredder residue is typically accepted at a cost, consistent with the user fee schedule for the landfill.

# Demographic Analysis

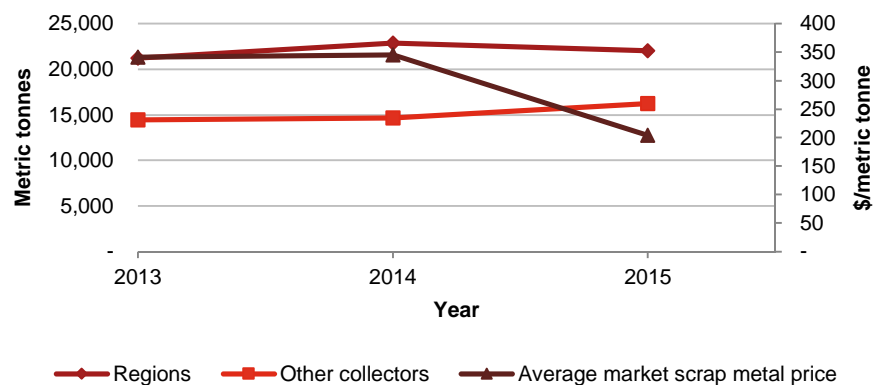
- There are over 56 landfills and 61 recyclers in British Columbia that are involved in the recycling of EoL appliances. The majority of these landfills and recyclers are in southern British Columbia within a 5 hour drive of Vancouver.
- For both our mandates, our starting point was a demographic analysis, which we used to select a sample of regions upon which to focus our analysis.
- Our demographic analysis considered a number of factors, but focused on geographic diversity and population density, as our research indicates that these are the primary factors that would lead to economic and process differentiation in the EoL appliance recycling process.
- Our analysis (source: 2011 census data) is presented in the chart below. As agreed upon with MARR, we selected 5 rural/remote regions (highlighted in yellow) and 2 urban regions (highlighted in blue).

Census Division (Regional District)	Median age of the population	Total population by age groups	Population density per square kilometre	Total private dwellings	Average after-tax household income (\$)	Median after-tax household income (\$)	Number of Collection Sites	Population per Collection Site
Stikine	49.3	625	0	571	98,868	86,876	n/a	n/a
Central Coast	40	3,205	0.1	1,413	81,414	65,752	1	3,205
Northern Rockies	33.1	5,575	0.1	2,495	140,948	120,835	1	5,575
Kitimat-Stikine	40.3	37,360	0.4	16,780	101,417	88,038	6	6,227
<b>Bulkley-Nechako</b>	<b>39.3</b>	<b>39,210</b>	<b>0.5</b>	<b>17,406</b>	<b>105,884</b>	<b>91,657</b>	<b>8</b>	<b>4,901</b>
Peace River	34.3	60,085	0.5	25,854	125,109	111,476	13	4,622
<b>Mount Waddington</b>	<b>41.8</b>	<b>11,505</b>	<b>0.6</b>	<b>5,969</b>	<b>99,594</b>	<b>89,293</b>	<b>6</b>	<b>1,918</b>
Cariboo	45.1	62,390	0.8	30,452	97,160	85,430	25	2,496
Skeena-Queen Charlotte	39.9	18,785	0.9	9,143	96,866	85,794	5	3,757
Columbia-Shuswap	48.1	50,510	1.7	28,430	91,789	82,816	14	3,608
Fraser-Fort George	39.5	91,880	1.8	41,520	109,211	97,564	4	22,970
East Kootenay	44.5	56,685	2.1	33,081	114,627	99,180	11	5,153
Squamish-Lillooet	36.2	38,170	2.3	22,146	113,231	97,021	6	6,362
Strathcona	46.3	43,255	2.4	21,033	104,711	90,492	7	6,179
Central Kootenay	47.4	58,440	2.6	29,474	95,078	82,006	18	3,247
<b>Thompson-Nicola</b>	<b>44</b>	<b>128,475</b>	<b>2.9</b>	<b>59,888</b>	<b>105,420</b>	<b>93,450</b>	<b>19</b>	<b>6,762</b>
<b>Kootenay Boundary</b>	<b>49.6</b>	<b>31,135</b>	<b>3.9</b>	<b>18,448</b>	<b>97,323</b>	<b>85,148</b>	<b>8</b>	<b>3,892</b>
Powell River	50.6	19,905	3.9	11,000	93,972	79,832	3	6,635
Alberni-Clayoquot	45.1	31,065	4.7	15,305	89,641	81,403	5	6,213
Sunshine Coast	51.6	28,620	7.6	16,498	107,744	92,518	3	9,540
Okanagan-Similkameen	52	80,740	7.8	41,168	93,343	79,783	9	8,971
<b>North Okanagan</b>	<b>47.2</b>	<b>81,235</b>	<b>10.8</b>	<b>38,208</b>	<b>99,614</b>	<b>85,313</b>	<b>6</b>	<b>13,539</b>
Fraser Valley	39.6	277,595	20.8	110,940	103,868	90,946	13	21,353
Cowichan Valley	47.2	80,330	23.1	35,922	100,410	89,268	4	20,083
Comox Valley	48.3	63,540	37.4	30,156	100,103	89,192	2	31,770
Central Okanagan	44.2	179,840	61.9	83,836	109,654	93,868	5	35,968
Nanaimo	49.3	146,575	71.9	70,687	99,035	87,200	9	16,286
<b>Capital</b>	<b>44.8</b>	<b>359,990</b>	<b>153.8</b>	<b>177,977</b>	<b>115,675</b>	<b>101,573</b>	<b>10</b>	<b>35,999</b>
<b>Greater Vancouver</b>	<b>40.2</b>	<b>2,313,325</b>	<b>802.5</b>	<b>949,565</b>	<b>120,869</b>	<b>102,291</b>	<b>24</b>	<b>96,389</b>



# Trends in EoL Appliance Recycling in BC

## Estimated tonnes of Appliances Collected vs Avg Scrap Metal Price



- We note that although the average market scrap metal price has declined significantly in 2015, the total amount of EoL appliances collected has not changed significantly during the same period.

# *Economic Model*

# *Approach and Methodology*

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## **Methodology**

- As previously stated, the key steps in our methodology for assessing the economics of recycling EoL major appliances are as follows:
  - Identifying which components/processes/activities generate costs and/or revenues for recycling major appliances for each type of market participant;
  - Identifying the costs and/or revenues for recycling major appliances by region type and the major drivers impacting those costs and revenues;
  - Identifying market failures and the region types in British Columbia where costs likely exceed the revenues for the recycling of major appliances; and
  - Performing an analysis on the financial sensitivity of the market to fluctuations in major cost and revenue drivers across region types (e.g. scrap metal commodity price).
- For each of the key players in the EoL appliance recycling process, we have modelled their profitability based on interviews and surveys of various companies.
- This analysis is generally based on British Columbia as a whole.
- We have also prepared a sensitivity analysis based on metal prices and other factors as considered appropriate.

# Regional Districts

## Introduction

- Regional districts receive EoL appliances from consumers and retailers who drop them off at collection sites. The regional district is responsible for removing ODS materials and sending the EoL appliances to a recycler for further processing.
- Maps and other information on the regional districts we contacted are summarized in Appendices 3 to 8.

## Revenue Drivers

- Tipping fees:** Regional districts earn revenues from tipping fees charged to consumers or to retailers for EoL appliances dropped off at collection sites. The tipping fee typically varies by region and depending on whether the appliance contains ODS. On average, regional districts charge a tipping fee of \$11.60 (ranging from \$nil to \$20) per appliance with ODS and \$0.90 (ranging from \$nil to \$5.00) per appliance without ODS.
- Revenue from scrap metal:** Regional districts also receive proceeds from the sale of scrap metal contained in the EoL appliances, which is commonly based on prevailing market metal prices. We understand that this price is typically based on the American Metals Market monthly floating rate for the metals, less a fixed per tonne processing fee. This revenue may also be adjusted for transportation and baling costs, depending on whether the regional district or the recycler is responsible for transportation and baling of the appliances.

For the purposes of our analysis, we have adjusted all information received to reflect a scrap metal price net of transportation and baling costs. In 2015, the average scrap metal revenue received by regional districts was approximately \$40 per tonne net of transportation costs (2013 - \$100 / tonne). Based on the average weight of appliances which contain ODS and those without, this translates to revenues of approximately \$4.20 (2013 - \$10.40) per appliance which contains ODS and \$2.70 (2013 - \$6.80) per appliance without ODS.

## Overall Findings

*Our analysis indicates that regional districts incur a loss on EoL appliance recycling programs on a standalone basis, before consideration of the allocation of tax revenues. An improvement in metal prices could help to reduce the losses incurred by regional districts.*

*We understand that regional districts aim to operate at a breakeven position, which requires scrap metal prices (net of transportation costs) of \$120 and \$190 per tonne for ODS and non-ODS appliances, respectively. Given that transportation costs are higher in rural districts, a rural district would need higher gross scrap metal prices in order to break even. This is because the transportation costs for rural districts are higher and, as such, their net proceeds for a given metal price are lower.*

*The breakeven tipping fee (i.e. the tipping fee at which collection and recycling of EoL appliances has no net cost) for urban ODS and non-ODS appliances is \$18.80 and \$10.60 per unit, respectively and for rural ODS and non-ODS appliances is \$20.85 and \$11.95 per unit, respectively. At 2013 metal prices, the breakeven tipping fee for ODS and non-ODS appliances would be \$13.60 and \$7.20 per unit, respectively.*

# Regional Districts

## Revenue Drivers (continued)

- **Tax revenues:** A portion of the tax revenue generated by regional districts is also allocated to waste disposal, which would include recycling of EoL appliances. However, we note that regional districts do not separately budget for EoL appliance recycling.

From a financial standpoint, we note that although the programs generate losses, the individual regional districts have reported either a small surplus or a small deficit, which suggests that their tax revenues are generally sufficient to cover any losses generated by major appliance recycling programs. However, lower metal prices have reduced the motivation of regional districts to continue in the future with their recycling activities. This has already been reflected in the manner that some regional districts address the recycling of major appliances, as detailed in the “Additional Evidence”.

## Cost Drivers

- **Transportation cost:** Some regional districts are responsible for the cost of transporting metal to the recycler, although our research indicates that most recyclers are responsible for the pickup of the metal and appliances from the regional district’s warehouse as they will also bale the EoL appliances. For the purposes of our analysis, we have deducted transportation costs from the scrap metal revenues. As such, we have not assessed transportation costs separately in our analysis.

For reference, in the “Recyclers” section, we have prepared an analysis of the cost to transport scrap metal.

## Summary Representative Model

	Per unit		Total
	ODS	Non-ODS	
<b>Revenues</b>			
Tipping fees	11.60	0.90	
Scrap metal revenues *	4.20	2.70	
	<b>15.80</b>	<b>3.60</b>	
<b>Costs</b>			
Staff and equipment	11.00	11.00	
ODS removal	10.00	-	
Administration	3.00	3.00	
	<b>24.00</b>	<b>14.00</b>	
Profit (loss) per unit	<b>(8.20)</b>	<b>(10.40)</b>	
Estimated number of appliances collected annually in BC	171,000	279,000	450,000
<b>Total profit (loss)</b>	<b>(1,402,200)</b>	<b>(2,901,600)</b>	<b>(4,303,800)</b>

\* Based on current metal prices

# Regional Districts

## Cost Drivers (continued)

- **Equipment cost:** Appliances are typically baled prior to transportation to reduce the space requirement, which reduces transportation costs. Many recyclers have mobile baling units which they will bring on site to bale the major appliances prior to transportation. Other municipalities will rent equipment to bale the EoL appliances prior to transporting them to recyclers. The cost for renting such equipment ranges from \$100 to \$200 per hour. We have utilized scrap metal revenues which are net of equipment costs and have not assessed the equipment cost separately.
- **Staff and equipment cost:** Staff and equipment costs relate to movement of EoL appliances within a regional district. Based on our review, we have assumed an average labour and equipment cost of \$11.00/unit.
- **ODS removal:** Cost for ODS removal by a contractor, which is usually performed on-site. The cost for removing ODS substances varies by the type of appliance and the difficulty of removing the ODS. It typically ranges from \$8 to \$12 per appliance. For the purposes of our analysis, we have assumed a cost of \$10 per appliance.

*Profitability of ODS removal:* You have asked us to provide a calculation of the profitability/cost of removing ODS in EoL appliances from the regional districts' perspective. We note that, on average, the tipping fee for ODS appliances is \$12.90 higher than for non-ODS appliances, which more than offsets the average ODS removal cost of \$10.00. The difference of \$2.90 is used to offset the other costs incurred by regional districts in recycling EoL appliances.

In addition, we note that ODS appliances earn scrap metal revenues which are, on average, \$1.50 higher per unit compared to non-ODS appliances. This difference relates to the higher average weight of ODS appliances. This indicates that, in total, ODS appliances cost result in a loss to regional districts which is \$4.40 per unit lower than non-ODS appliances.

## Cost Drivers (continued)

- **Administration costs:** Administration costs, including office staff costs. The data provided reflects an overhead cost which regional districts view as being appropriate for administering the EoL appliance recycling function. Based on our review, we have assumed administration costs of \$3.00 per appliance.
- **Land rental:** Rental costs for land upon which the collection sites are located, if the land is not publicly owned. This can range widely depending on the regional district, how major appliances are stored and the length of time before major appliances are sent to recyclers. For the purposes of our analysis, we have assumed that such costs are minimal and that, absent the EoL appliance recycling program, regional districts would have continued to rent this space for other recycling programs and thus have not separately considered it.

## Unit Profit (Loss)

- Based on the above assumptions and considerations, the per unit profit (loss) incurred by regional districts is (\$8.20) for EoL appliances with ODS and (\$10.40) for appliances without ODS, before consideration of tax revenues.

# Regional Districts

## Units Collected

- We considered the following indicators in assessing the units collected by regional districts in 2015:
  - In 2015, MARR estimates that regional districts collected 22,032 tonnes of EoL appliances. Based on the average weight of an appliance (between 75kgs to 100kgs), this represents approximately 250,000 EoL appliances. We understand that MARR's reported tonnage data is based on data from 2005 extrapolated to 2015, which may not reflect the most current data.
  - Recyclers do not track the volume of EoL appliances as they receive scrap metal that is a combination of different products.
  - MARR's members reported in 949,075 units of major appliances were sold in 2015. BC Housing reported that 30,377 new homes were registered in 2015. Assuming that a new home requires approximately 5 appliances (refrigerator, stove, dishwasher, clothes washer and clothes dryer), this indicates that 151,885 appliances were purchased but did not replace an existing appliance, which would have to be recycled. This suggests that approximately 800,000 major appliances would be recycled as a result of the replacements. MARR's 2015 annual report states that 57.5% of appliances are recycled through regional districts (with the remainder through retailers, recyclers and other facilities) with an overall collection rate of 98.7%. This suggests that approximately 450,000 appliances were collected by regional districts.

## Units Collected (continued)

- The regional districts we surveyed indicated that they do not track collection of non-ODS appliances, but do track collection of ODS appliances due to the need to process the ODS. Five regional districts provided data from 2014 / 2015 which suggested that they collected approximately 26,100 appliances in total, across a stated population (from the 2011 census) of 2.41 million. Extrapolating across the total BC population of 4.40 million implies that 47,700 ODS appliances were collected in 2015. Approximately 38% of appliances sold in 2015 in BC related to appliances containing ODS. Assuming a similar rate applies to recycled appliances, this data indicates that approximately 126,000 appliances were collected by regional districts in 2015.
- Based on the above, it is clear that there is not a reliable method for tracking the volume of recycled EoL appliances. We have provided some suggestions to improve this in our rural and remote communities study.
- For the purposes of our analysis and as requested by Management, we have relied upon the 2015 sales as the basis for our analysis and assumed that approximately 450,000 appliances were collected by regional districts.
- A breakdown between ODS and non-ODS EoL appliances was not available. However, we note that 38% of appliances sold in 2015 in BC related to appliances containing ODS. We have applied a similar proportion to the EoL appliances, which implies that 171,000 ODS EoL appliances and 279,000 non-ODS EoL appliances were collected by regional districts.

## Overall Profit (Loss)

- This suggests that, in 2015, regional districts on aggregate earned a profit (incurred a loss) of (\$4,303,800) from collecting and recycling major appliances, prior to consideration of tax revenues.

# Regional Districts

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## Additional Evidence

- Declining metal prices have had a negative impact on the profitability of the EoL appliance recycling operations for the regional districts we surveyed. In particular, some rural and remote regional districts note that they have stockpiled EoL appliances, with the goal of selling this stockpile only when metal prices increase. In this regard we note that our analysis on the profitability of recycling EoL appliances assumes that major appliances are being recycled by regional districts in an efficient manner.
- The above is exacerbated by the limited ability of regional districts to negotiate pricing from recyclers. This is particularly true for rural and remote communities, which are located further from recyclers. We understand that the key driver of any difference in the price of scrap metal offered to a rural versus urban district is driven primarily by transportation costs as most recyclers are located in southern BC, closer to urban communities.
- We note the existence of the following practices regarding EoL appliance recycling, which impacts the overall efficiency of the EoL recycling process and which supports our above analysis:
  - Some regional districts report stockpiling of major appliances until scrap metal prices recover. Other regional districts indicate that they would pursue this option if sufficient space was available to them.
  - Some regional districts have reported that, in some years, they were not able to obtain scrap metal revenues from recyclers due to the metal price environment, a knowledge gap and/or weaker bargaining position.
  - Some recyclers may decline to collect scrap metal from rural communities if the transportation costs outweigh the revenues they would generate from the scrap metal.
  - Most recyclers have not noted any change in the volume of EoL processed as a result of declining metal prices (one recycler indicated “somewhat” of a decline). However, as noted previously, recyclers usually receive scrap metal that is a combination of EoL appliances and other products and, as such, their observations may not provide an accurate picture of EoL appliances.



# Regional Districts

## Sensitivity Analysis – Rural vs. Urban

- We have provided a high level analysis of the potential difference in scrap metal revenues earned by a rural vs. an urban district. We note that the scrap metal prices provided above of \$40 / tonne is derived primarily from rural districts. We note that these rural districts are geographically dispersed.
- Due to the variation in transportation cost, recyclers did not provide details regarding scrap metal prices after consideration of transportation costs, but provided current scale prices (price paid to someone who delivers metal to a scrap yard). The scale prices had a broad range, from \$35 per tonne in Kelowna up to \$55 per tonne in Vancouver.
- To support the above, we have also considered the following analysis. The difference between the fees earned by rural vs. urban areas is primarily driven by the additional transportation costs. The distance between an urban area and the recycler is generally in the 50 to 100 km range where the distance between a rural area and the recycler has a much wide range. For the purposes of our analysis, we have assumed that, on average, rural areas are 150 to 200 km from a recycler. Assuming that recyclers need to make a round trip, this implies that a recycler who is transporting scrap metal from an urban area travels a shorter distance by approximately 200 km:

Truckload rate (per kilometer per tonne) <sup>1</sup>	\$	2.00
Tonnes per truckload		20
<b>Rate per tonne per kilometer</b>	<b>\$</b>	<b>0.10</b>
Difference in distance (in kilometers)		200
<b>Incremental scrap metal price per tonne</b>	<b>\$</b>	<b>20.00</b>

1. Based on research of average truckload rates per kilometer per tonne. Note that this rate varies significantly depending upon the transportation equipment used, whether the EoL appliances have been decommissioned and compacted / baled metal (depending on the other materials transported).

- For the purposes of our illustrative analysis, we have utilized net revenues from scrap metal of \$30 per tonne for rural areas and \$50 per tonne for urban areas.
- The following illustrates the potential change in profit (loss) earned per unit by rural vs. urban districts:

	Urban, per unit		Rural, per unit	
	ODS	Non-ODS	ODS	Non-ODS
Scrap metal price				
- per tonne	50.00	50.00	30.00	30.00
- per unit	5.20	3.40	3.15	2.05
<b>Revenues</b>				
Tipping fees	11.60	0.90	11.60	0.90
Scrap metal revenues	5.20	3.40	3.15	2.05
	<b>16.80</b>	<b>4.30</b>	<b>14.75</b>	<b>2.95</b>
<b>Costs</b>				
Staff and equipment	11.00	11.00	11.00	11.00
ODS removal	10.00	-	10.00	-
Administration	3.00	3.00	3.00	3.00
	<b>24.00</b>	<b>14.00</b>	<b>24.00</b>	<b>14.00</b>
<b>Profit (loss) per unit</b>	<b>(7.20)</b>	<b>(9.70)</b>	<b>(9.25)</b>	<b>(11.05)</b>

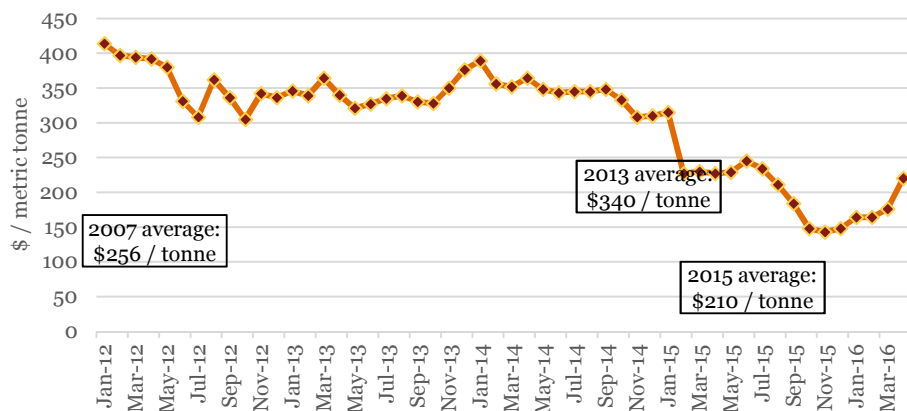
- This indicates that urban districts incur a loss on recycling each unit of major appliance, although it is not as substantial as the one incurred by rural districts.
- We note that the break-even tipping fee (i.e. the tipping fee at which collection and recycling of EoL appliances has no net cost) for urban ODS and non-ODS appliances is \$18.80 and \$10.60 per unit, respectively and for rural ODS and non-ODS appliances is \$20.85 and \$11.95 per unit, respectively.

# Regional Districts

## Sensitivity Analysis – Metal Pricing

- We performed an analysis in regards to the sensitivity of revenue and operating profit to scrap metal prices. The majority of the regional districts generate revenue from the sale of scrap metal removed from major appliances collected.
- As previously discussed, the average scrap metal price received by regional districts declined from \$100 / tonne in 2013 to \$40 / tonne in 2015. This appears to be reflective of the decline in the American Metals Market scrap metal prices, given that a portion of the scrap metal price represents fixed cost deductions (e.g. baling, transportation):

American Metals Market Average Scrap Metal Prices



- As indicated above, scrap metal prices increased by approximately 33% between 2007 and 2013, before declining by 38% between 2013 and 2015.
- We replicated our profit / loss analysis (see opposite) and noted that, at the 2013 prices, regional districts are still operating at a loss, but it was substantially smaller, particularly for EoL appliances which contain ODS.

	Per unit		Total
	ODS	Non-ODS	
<b>Revenues</b>			
Tipping fees	11.60	0.90	
Scrap metal revenues	10.40	6.80	
	<b>22.00</b>	<b>7.70</b>	
<b>Costs</b>			
Staff and equipment	11.00	11.00	
ODS removal	10.00	-	
Administration	3.00	3.00	
	<b>24.00</b>	<b>14.00</b>	
Profit (loss) per unit	<b>(2.00)</b>	<b>(6.30)</b>	
Estimated number of appliances collected annually in BC	171,000	279,000	450,000
<b>Total profit (loss)</b>	<b>(342,000)</b>	<b>(1,757,700)</b>	<b>(2,099,700)</b>

- We note that the breakeven price (i.e. the scrap metal price at which collection and recycling of EoL appliances has no net cost) for ODS and non-ODS appliances is \$12.40 and \$13.10 per unit, respectively. This translates to approximately \$120 and \$190 per tonne, respectively.
- At 2013 metal prices, the breakeven tipping fee for ODS and non-ODS appliances is \$13.60 and \$7.20 per unit, respectively.

# Regional Districts

## Sensitivity Analysis – Tipping Fees

- You have asked us to provide an analysis of the overall profitability of the system if tipping fees were excluded:

	Per unit		Total
	ODS	Non-ODS	
<b>Revenues</b>			
Revenue from scrap metal *	4.20	2.70	
	<u>4.20</u>	<u>2.70</u>	
<b>Costs</b>			
Staff and equipment	11.00	11.00	
ODS removal	10.00	-	
Administration	3.00	3.00	
	<u>24.00</u>	<u>14.00</u>	
Profit (loss) per unit	<b>(19.80)</b>	<b>(11.30)</b>	
Estimated number of appliances collected annually in BC	171,000	279,000	450,000
<b>Total profit (loss)</b>	<b>(3,385,800)</b>	<b>(3,152,700)</b>	<b>(6,538,500)</b>

\* Based on current metal prices

- This analysis indicates that, by excluding tipping fees, the per unit loss would increase to \$19.80 per ODS appliance and \$11.30 per non-ODS appliance. As a result, the total loss incurred by regional districts would increase to \$6,538,500.

- For reference, we have also considered the profit (loss) per unit for urban and rural districts.

	Urban, per unit		Rural, per unit	
	ODS	Non-ODS	ODS	Non-ODS
<b>Revenues</b>				
Scrap metal price				
- per tonne	50.00	50.00	30.00	30.00
- per unit	5.20	3.40	3.15	2.05
<b>Revenues</b>				
Scrap metal revenues	<u>5.20</u>	<u>3.40</u>	<u>3.15</u>	<u>2.05</u>
	<u>5.20</u>	<u>3.40</u>	<u>3.15</u>	<u>2.05</u>
<b>Costs</b>				
Staff and equipment	11.00	11.00	11.00	11.00
ODS removal	10.00	-	10.00	-
Administration	3.00	3.00	3.00	3.00
	<u>24.00</u>	<u>14.00</u>	<u>24.00</u>	<u>14.00</u>
<b>Profit (loss) per unit</b>	<b>(18.80)</b>	<b>(10.60)</b>	<b>(20.85)</b>	<b>(11.95)</b>

# Retailers

## Introduction

- Retailers pick up EoL appliances from consumers who purchase new appliances either directly or through a third party transportation contractor. Larger retailers will hire an ODS remover to remove ODS and send the EoL appliances to a recycler. Smaller retailers usually drop the appliances off at regional district collection sites.
- As many retailers operate in multiple regional districts, our analysis is focused on retailers in aggregate.

## Revenue Drivers

- **Pick-up fees:** Revenues for retailers primarily come from pick-up fees charged to consumers (customers). Based on our review, the average stated pick-up fee charged by retailers is \$25 per appliance. As previously discussed, some retailers will waive this fee to effect a sale. However, for the purpose of our have assumed that in these situations, the pick-up fee is effectively built into the price of a new appliance and therefore, retailers effectively earn average revenues of \$25 per appliance.
- **Revenues from scrap metal:** Retailers who sell EoL appliances directly to recyclers receive revenues from the recyclers, at prices similar to the one received by regional districts. This fee is analysis, we also adjusted for transportation costs, depending on whether the retailer or the recycler is responsible for transportation of the appliances.

Similar to our regional district analysis, we have adjusted scrap metal prices for transportation costs. In 2015, we have assumed that the average scrap metal revenue received by retailers was approximately \$40 per tonne net of transportation costs (2013 - \$100 / tonne). Based on the average weight of appliances, this translates to fees of \$3.50 per appliance (2013 - \$8.75 / appliance).

## Overall Findings

*Retailers view their major appliance recycling programs to operate at a loss due to the substantial transportation costs associated with transporting appliances. We note that EoL appliances are often picked up when new appliances are delivered, and therefore the transportation costs associated with the EoL appliance program on a standalone basis should be marginal. The inclusion / exclusion of such costs has a significant impact on the overall profitability of the program, irrespective of the scrap metal price. In the table below we have excluded transportation costs.*

*We further note that our analysis excludes the impact of secondary revenues received by retailers from the refurbishment, resale and/or donation of a portion of the EoL appliances collected. All else being equal, we expect that this would increase the profit (reduce the losses) of retailers from the EoL appliance process.*

*However, we note that retailers view the collection of EoL appliances as a service that they offer to their customers, and that most retailers offer a similar service. As such, their EoL appliance recycling programs are not driven by profitability.*

# Retailers

## Revenue Drivers (continued)

- Revenues from secondary markets: We understand that some retailers do not recycle all of the EoL appliances they receive, but will refurbish, resell and/or donate a portion of such appliances. Information with respect to the proportion of EoL appliances not recycled by retailers and/or the revenues (if any) received by retailers has not been provided and, as such, has not been explicitly considered in our analysis. However, all else being equal, we note that this increase the profit (reduce the losses) of retailers.

## Cost Drivers

- Transportation cost – from consumers to retailer warehouse: EoL appliances have to be transported from consumers to the retailer warehouse. Based on data provided by retailers, we understand that transportation costs average approximately \$35 per appliance. We note that the trip would have to be made absent collecting the EoL appliance, as the retailer delivers a new appliance during the same trip, but there are incremental costs as many retailers utilize third party carriers. We have therefore considered half of the transportation cost in our analysis (i.e. \$17.50 per appliance).
- Transportation cost – from retailer warehouse to collection site / recycler: The cost of transporting appliances from the retailer warehouse to recyclers has been adjusted for in the scrap metal price. We understand that some retailers will transport appliances to recyclers where other recyclers will pick up appliances from the retailer. As the transportation cost has been deducted from the scrap metal price, we have not assessed transportation costs separately in our analysis.

## Summary Model

	Collection Site - Per unit		Recycler - Per unit		Total
	ODS	Non-ODS	ODS	Non-ODS	
<b>Revenues</b>					
Tipping fees	25.00	25.00	25.00	25.00	
Revenue from scrap metal	-	-	4.20	2.70	
	<u>25.00</u>	<u>25.00</u>	<u>29.20</u>	<u>27.70</u>	
<b>Costs</b>					
Tipping fee	11.60	0.90	-	-	
Transportation cost	17.50	17.50	17.50	17.50	
Staff and equipment	-	-	-	-	
ODS removal	-	-	10.00	-	
Storage cost	3.50	3.50	3.50	3.50	
Administration	-	-	-	-	
	<u>32.60</u>	<u>21.90</u>	<u>31.00</u>	<u>21.00</u>	
Profit (loss) per unit	<b>(7.60)</b>	<b>3.10</b>	<b>(1.80)</b>	<b>6.70</b>	
Appliances	10,260	16,740	92,340	150,660	270,000
<b>Total profit (loss)</b>	<b>(77,976)</b>	<b>51,894</b>	<b>(166,212)</b>	<b>1,009,422</b>	<b>817,128</b>

# Retailers

## Cost Drivers (continued)

- **Storage cost:** The cost of storing EoL appliances at warehouses comes with an associated storage cost. We have estimated the cost of storing EoL appliances based on the following:
  - Each appliance takes up approximately space of approximately 1m<sup>2</sup> prior to processing (i.e. baling), which is only completed just before recyclers pick up and transport the appliance.
  - Pick up of EoL appliances from retailers varies significantly. For the purposes of our analysis, we have assumed that EoL appliances are picked up on a bi-weekly basis.
  - The average annual rent in British Columbia ranges from \$8 to \$9 per square foot, which implies that the storage cost per appliance is approximately \$3.50.
- **Tipping fees:** Retailers who drop off appliances at regional districts incur tipping fees, which would differ depending on whether the EoL appliance contains ODS. We have applied a fee of \$14.50 and \$1.60 per appliance for EoL appliances with and without ODS, respectively, consistent with our analysis of regional districts.
- **ODS removal:** Cost for ODS removal by a contractor relates only to EoL appliances sold to recyclers. ODS removal is either performed on site or at the recycler site. For the purposes of our analysis, given that scrap metal revenues are based on EoL appliances subsequent to removal of ODS, we have assumed that ODS fees should be deducted. ODS fees typically range from \$8 to \$12 per appliance. For the purposes of our analysis, we have assumed a cost of \$10 per appliance for appliances sent to recyclers.
- **Administration costs:** There are administrative costs related to the collection of EoL appliances by retailers. Based on discussions with retailers, we understand that they do not track such administrative costs separately as they view the administrative costs to be part of the appliance sale. We have therefore, not considered administration costs in our analysis.

## Unit Profit (Loss)

- Based on the above, we have considered 4 levels of unit profit (loss) :

Transported to:	Collection Site	Recycler
<b>With ODS</b>	(\$7.60)	(\$1.80)
<b>Without ODS</b>	\$3.10	\$6.70

# Retailers

## Units Collected

- As previously discussed, our analysis is based on 2015 sales data reported by MARR's members. This indicates that approximately 800,000 major appliances would be recycled as a result of appliance replacements. MARR's 2015 annual report indicates that 34% of appliances are recycled through retailers with an overall collection rate of 98.7%. This indicates that approximately 270,000 appliances were collected by regional districts.
- Furthermore, a breakdown between ODS and non-ODS EoL appliances suggests that 38% of appliances sold in 2015 in BC related to appliances containing ODS (or 102,600 appliances).
- We have not been provided with a breakdown between the appliances sent to a collection site versus a recycler. However, for the purposes of our analysis, we have assumed that 10% of appliances are sent to a collection site, with the remaining 90% going to a recycler.

## Overall Profit (Loss)

- This suggests that, in 2015, retailers on aggregate earned a profit (incurred a loss) of \$817,128 from collecting and recycling major appliances.

## Additional Evidence

- Our discussion with retailers suggest that they view the transportation costs to be part of the cost of collecting EoL appliances, and that the cost of transporting the appliances currently outweighs any revenues generated from the sale of scrap metal and/or haul-away fees. Although they view EoL appliance collection programs to operate at a loss, these services are offered by retailers as a “necessary evil” in order to maintain competitiveness.
- As a sensitivity, we replicated our analysis incorporating the full cost of transporting appliances, which resulted in an overall loss of \$3,907,872:

	Collection Site - Per unit		Recycler - Per unit		Total
	ODS	Non-ODS	ODS	Non-ODS	
<b>Revenues</b>					
Tipping fees	25.00	25.00	25.00	25.00	
Revenue from scrap metal	-	-	4.20	2.70	
	<u>25.00</u>	<u>25.00</u>	<u>29.20</u>	<u>27.70</u>	
<b>Costs</b>					
Tipping fee	11.60	0.90	-	-	
Transportation cost	35.00	35.00	35.00	35.00	
Staff and equipment	-	-	-	-	
ODS removal	-	-	10.00	-	
Storage cost	3.50	3.50	3.50	3.50	
Administration	-	-	-	-	
	<u>50.10</u>	<u>39.40</u>	<u>48.50</u>	<u>38.50</u>	
Profit (loss) per unit	<b>(25.10)</b>	<b>(14.40)</b>	<b>(19.30)</b>	<b>(10.80)</b>	
Appliances	10,260	16,740	92,340	150,660	270,000
<b>Total profit (loss)</b>	<b>(257,526)</b>	<b>(241,056)</b>	<b>(1,782,162)</b>	<b>(1,627,128)</b>	<b>(3,907,872)</b>

- We note also that the decline in scrap metal prices does not appear to have had an impact on the inclination of retailers to recycle EoL appliances due to their motivations, which include providing services to their customers.

# Retailers

## Sensitivity Analysis – Rural vs. Urban

- We have provided a high level analysis of the potential difference in revenues from scrap metal and profit (loss) per unit earned by a retailer located in a rural vs. urban district, using scrap metal prices consistent with our regional district analysis. Note that this would not have an impact on the profit (loss) if the appliances were sent to a collection site.
- This analysis suggests that retailers who send EoL appliances to a recycler earn a higher profit (incur a lower loss) if they are located in an urban region.

Rural	Collection Site - Per unit		Recycler - Per unit	
	ODS	Non-ODS	ODS	Non-ODS
<b>Revenues</b>				
Tipping fees	25.00	25.00	25.00	25.00
Revenue from scrap metal	-	-	3.15	2.05
	<b>25.00</b>	<b>25.00</b>	<b>28.15</b>	<b>27.05</b>
<b>Costs</b>				
Tipping fee	11.60	0.90	-	-
Transportation cost	17.50	17.50	17.50	17.50
Staff and equipment	-	-	-	-
ODS removal	-	-	10.00	-
Storage cost	3.50	3.50	3.50	3.50
Administration	-	-	-	-
	<b>32.60</b>	<b>21.90</b>	<b>31.00</b>	<b>21.00</b>
<b>Profit (loss) per unit</b>	<b>(7.60)</b>	<b>3.10</b>	<b>(2.85)</b>	<b>6.05</b>

Urban	Collection Site - Per unit		Recycler - Per unit	
	ODS	Non-ODS	ODS	Non-ODS
<b>Revenues</b>				
Tipping fees	25.00	25.00	25.00	25.00
Revenue from scrap metal	-	-	5.20	3.40
	<b>25.00</b>	<b>25.00</b>	<b>30.20</b>	<b>28.40</b>
<b>Costs</b>				
Tipping fee	11.60	0.90	-	-
Transportation cost	17.50	17.50	17.50	17.50
Staff and equipment	-	-	-	-
ODS removal	-	-	10.00	-
Storage cost	3.50	3.50	3.50	3.50
Administration	-	-	-	-
	<b>32.60</b>	<b>21.90</b>	<b>31.00</b>	<b>21.00</b>
<b>Profit (loss) per unit</b>	<b>(7.60)</b>	<b>3.10</b>	<b>(0.80)</b>	<b>7.40</b>



# Retailers

## Sensitivity Analysis – Metal Prices

- We performed an analysis in regards to the sensitivity of revenue and operating profit to scrap metal prices, assuming the inclusion of transportation costs (as retailers already operate at a profit if transportation costs are excluded). We note that a change in metal prices would only have an impact on retailers who sell scrap metal to recyclers.
- As previously discussed, the average scrap metal price received by regional districts declined from \$100 / tonne in 2013 to \$40 / tonne in 2015. We replicated our profit / loss analysis (see opposite) and noted that, at the 2013 prices, the profit earned by retailers increases to \$2,007,342. If full transportation costs are included, the loss incurred by retailers is reduced to \$2,717,658.

	Collection Site - Per unit		Recycler - Per unit		Total
	ODS	Non-ODS	ODS	Non-ODS	
<b>Revenues</b>					
Tipping fees	25.00	25.00	25.00	25.00	
Revenue from scrap metal	-	-	10.40	6.80	
	<b>25.00</b>	<b>25.00</b>	<b>35.40</b>	<b>31.80</b>	
<b>Costs</b>					
Tipping fee	11.60	0.90	-	-	
Transportation cost	17.50	17.50	17.50	17.50	
Staff and equipment	-	-	-	-	
ODS removal	-	-	10.00	-	
Storage cost	3.50	3.50	3.50	3.50	
Administration	-	-	-	-	
	<b>32.60</b>	<b>21.90</b>	<b>31.00</b>	<b>21.00</b>	
Profit (loss) per unit	<b>(7.60)</b>	<b>3.10</b>	<b>4.40</b>	<b>10.80</b>	
Appliances	10,260	16,740	92,340	150,660	270,000
<b>Total profit (loss)</b>	<b>(77,976)</b>	<b>51,894</b>	<b>406,296</b>	<b>1,627,128</b>	<b>2,007,342</b>

	Collection Site - Per unit		Recycler - Per unit		Total
	ODS	Non-ODS	ODS	Non-ODS	
<b>Revenues</b>					
Tipping fees	25.00	25.00	25.00	25.00	
Revenue from scrap metal	-	-	10.40	6.80	
	<b>25.00</b>	<b>25.00</b>	<b>35.40</b>	<b>31.80</b>	
<b>Costs</b>					
Tipping fee	11.60	0.90	-	-	
Transportation cost	35.00	35.00	35.00	35.00	
Staff and equipment	-	-	-	-	
ODS removal	-	-	10.00	-	
Storage cost	3.50	3.50	3.50	3.50	
Administration	-	-	-	-	
	<b>50.10</b>	<b>39.40</b>	<b>48.50</b>	<b>38.50</b>	
Profit (loss) per unit	<b>(25.10)</b>	<b>(14.40)</b>	<b>(13.10)</b>	<b>(6.70)</b>	
Appliances	10,260	16,740	92,340	150,660	270,000
<b>Total profit (loss)</b>	<b>(257,526)</b>	<b>(241,056)</b>	<b>(1,209,654)</b>	<b>(1,009,422)</b>	<b>(2,717,658)</b>

# Retailers

## Sensitivity Analysis – Tipping Fees

- You have asked us to provide an analysis of the overall profitability of the system if tipping/collection fees were excluded as they represent an external input to the system.
- We replicated our profit / loss analysis (see opposite) and noted that, if the tipping / collection fee is excluded, the profit earned by retailers decreases to a loss of \$5,932,872. If full transportation costs are included, the loss incurred by retailers is increased to \$10,657,872.

	Collection Site - Per unit		Recycler - Per unit		Total
	ODS	Non-ODS	ODS	Non-ODS	
<b>Revenues</b>					
Revenue from scrap metal	-	-	4.20	2.70	
	-	-	4.20	2.70	
<b>Costs</b>					
Tipping fee	11.60	0.90	-	-	
Transportation cost	17.50	17.50	17.50	17.50	
Staff and equipment	-	-	-	-	
ODS removal	-	-	10.00	-	
Storage cost	3.50	3.50	3.50	3.50	
Administration	-	-	-	-	
	32.60	21.90	31.00	21.00	
Profit (loss) per unit	<b>(32.60)</b>	<b>(21.90)</b>	<b>(26.80)</b>	<b>(18.30)</b>	
Appliances	10,260	16,740	92,340	150,660	270,000
<b>Total profit (loss)</b>	<b>(334,476)</b>	<b>(366,606)</b>	<b>(2,474,712)</b>	<b>(2,757,078)</b>	<b>(5,932,872)</b>

	Collection Site - Per unit		Recycler - Per unit		Total
	ODS	Non-ODS	ODS	Non-ODS	
<b>Revenues</b>					
Revenue from scrap metal	-	-	4.20	2.70	
	-	-	4.20	2.70	
<b>Costs</b>					
Tipping fee	11.60	0.90	-	-	
Transportation cost	35.00	35.00	35.00	35.00	
Staff and equipment	-	-	-	-	
ODS removal	-	-	10.00	-	
Storage cost	3.50	3.50	3.50	3.50	
Administration	-	-	-	-	
	50.10	39.40	48.50	38.50	
Profit (loss) per unit	<b>(50.10)</b>	<b>(39.40)</b>	<b>(44.30)</b>	<b>(35.80)</b>	
Appliances	10,260	16,740	92,340	150,660	270,000
<b>Total profit (loss)</b>	<b>(514,026)</b>	<b>(659,556)</b>	<b>(4,090,662)</b>	<b>(5,393,628)</b>	<b>(10,657,872)</b>

# ODS Removers

## Introduction

- The ODS remover removes ODS from EoL appliances. ODS removers travel to recyclers, collection sites and warehouses and take the ODS with them for disposal. There are no costs to the ODS remover associated with disposing of the ODS, although there is a freight charge (to ship the ODS to a disposal site) which is covered by an environmental fee which is collected when a product containing ODS is purchased. We have therefore excluded this from our analysis.
- As previously discussed, ODS removal has to be performed by approved persons. We understand that ODS removers often run their own businesses or the ODS removal services are part of a broader range of services offered by a company.
- We understand from discussions with regional districts that ODS removers tend to be located in larger centers due to the need for specific qualifications and the general demand for such services.

## Revenue Drivers

- **ODS Removal Fees:** Revenues for ODS removers come primarily from fees paid by regional districts and recyclers. These revenues typically range from \$8 to \$12 per appliance. For the purposes of our analysis, we have assumed revenues of \$10 per appliance.

## Overall Findings

*Before consideration of transportation costs, which could be significant, ODS removers earn a total profit of \$1,755,000. We note that the price charged by ODS removers is fairly consistent across the various service providers. Given the limited number of approved persons who can provide such services and their somewhat restricted geography, this suggests that ODS removers are able to price their services so that they are profitable.*

## Summary Model

<b>Revenues</b>	
ODS removal fees	10.00
<b>Costs</b>	
Transportation cost	2.75
Staff cost	1.10
Equipment cost	0.30
	<b>4.15</b>
Profit (loss) per unit	<b>5.85</b>
ODS appliances collected	300,000
<b>Total profit (loss)</b>	<b>1,755,000</b>

# ODS Removers

## Cost Drivers

- **Transportation cost:** ODS removers travel to the collection sites / warehouses as the cost and logistics of transporting EoL appliances makes the alternative impractical. The transportation cost for warehouses and collection facilities in rural and remote areas is significantly higher due to the limited number of approved persons who can remove ODS. As such, ODS removers have to travel relatively long distances to such areas.

There is limited information available with respect to the travel distance for the ODS removers. For the purposes of our analysis, we have considered the following analysis of transportation costs:

Average distance travelled (km) per trip <sup>1</sup>		300
Rate per km <sup>2</sup>	\$	0.55
Average appliances processed per trip <sup>3</sup>		60
<b>Transportation cost per appliance</b>	<b>\$</b>	<b>2.75</b>

1. The distance an ODS remover has to travel varies depending on the location of the ODS remover relative to the regional district. For the purposes of our analysis, we have assumed that the average distance travelled (on a round trip basis) is consistent with the distance travelled by recyclers.
2. Based on CRA's 2015 automobile allowance rate.
3. Based on discussions with ODS removers and regional districts, we understand that the number of appliances processed in a trip can vary significantly depending on the size of the regional district and its collection sites. We note that the information we were provided with indicates that, on average, 40 to 80 appliances are processed on each trip. For the purposes of our analysis, we have applied an average rate of 60 appliances per trip.

- **Staff cost:** The cost of employees to remove ODS. However, we note that many ODS removers operate their own companies and the staff costs relate to their salaries / earnings. We have estimated the wages paid to an ODS remover using data from the 2011 Census:

NAICS Code	Job Description	2010 dollars		2015 dollars	
		Median - Hourly	Median - Salaried	Median - Hourly	Median - Salaried
7301	Contractors and supervisors, mechanic trades	70,515	70,893	74,481	74,880
7313	Refrigeration and air conditioning mechanics	57,816	58,638	61,068	61,936
<b>Average of hourly and salaried codes</b>				<b>68,091</b>	
<b>Implied hourly wage</b>				<b>37.41</b>	
<b>Implied daily wage</b>				<b>262</b>	

Based on the above, we have considered an hourly wage of \$37.41, which translates to a daily cost of \$262.

Information provided by ODS removers indicates that the number of appliances an ODS remover can process in a day is dependent upon the amount of equipment an ODS remover owns, the distance which an ODS remover has to travel, whether the appliances are at multiple sites and whether the appliances are properly laid out and organized. This can range from 150 to 600 units, but not necessarily at a single site.

This implies a staff cost in the range of \$0.45 to \$1.75 per unit. For the purposes of our analysis, we have considered a staff cost of \$1.10 per unit.

# ODS Removers

## Cost Drivers (continued)

- **Equipment cost:** We understand that one of the most significant costs for an ODS remover is the equipment cost. A machine which removes ODS costs \$3,000, with an expected life span of 3 years (for machines which are primarily used for removing ODS from EoL appliances). It takes approximately 20 minutes to remove ODS from an appliance. Assuming that a machine is in use for 4 hours per day (after consideration of time required for transportation, set up and tear down), a machine would process 12 appliances per day, or 3,120 appliances per year. Thus, over a three year period, the equipment would, on average, cost approximately \$0.30 per appliance processed.

ODS removers pay a deposit of \$200 per canister, which is used to store ODS. However, the deposits are refunded when the canister is returned. The canisters are then repainted and reused. Therefore, on a net basis, the canisters do not have a significant cost to ODS removers and have been excluded from our analysis.

## Unit Profit (Loss)

- Based on the above considerations, the per unit profit (loss) incurred by ODS removers is \$5.85 for EoL appliances with ODS.

## Units Collected

- As previously discussed, our analysis is based on 2015 sales data reported by MARR's members. This indicates that approximately 800,000 major appliances would be recycled as a result of appliance replacements. MARR's 2015 annual report indicates an overall collection rate of 98.7%. A breakdown between ODS and non-ODS EoL appliances suggests that 38% of appliances sold in 2015 in BC related to appliances containing ODS (or 102,600 appliances). This indicates that approximately 300,000 ODS appliances were recycled in 2015.

## Overall Profit (Loss)

- This suggests that, in aggregate, ODS Removers earned a profit of \$1,755,000 from removing ODS from EoL appliances.

## Sensitivity Analysis

- A sensitivity analysis was not performed as ODS removers are not sensitive to metal prices.
- We note that, although some regional districts have indicated that they are stockpiling scrap metal until the price of metal increases, they are still having ODS removers come into their collection sites on a regular basis to remove ODS so that they can pile EoL appliances containing ODS with other non-ODS EoL appliances and other scrap metal.

# Recyclers

## Introduction

- This is a broad category that includes all types of players that use/process material from end-of-life appliances. The primary recyclers are companies involved in scrap processing and consolidation, shredders, large scale balers, and steel smelters.

## Revenue Drivers

- Fees from end users:** Revenues for recyclers primarily come from the sale of ferrous and non-ferrous metals to their end users. The quantum of these fees depend on metal prices. There is limited data available with respect to the revenues from end users as many recyclers process a wide variety of material from different sources. We have therefore considered the following analysis to estimate the fees from end users for an average appliance.

In 2005, a study was completed on the composition of various new and retired major home appliances. This study suggested the following composition of major appliances manufactured in 2005:

Appliance Type	Ferrous	Non-Ferrous	Plastic	Other
Side by Side Refrigerator	55.9%	5.8%	33.1%	5.2%
Top/Bottom Refrigerator	45.9%	7.1%	38.7%	8.3%
Freezers	81.4%	1.8%	15.2%	1.5%
Electric Range	83.9%	3.9%	1.4%	10.9%
Gas Range	86.7%	2.0%	2.2%	9.1%
Dishwasher	65.0%	4.4%	28.0%	2.5%
Gas Clothes Dryer	93.3%	3.9%	4.5%	0.1%
Electric Clothes Dryer	80.7%	3.9%	4.5%	10.9%
Clothes Washer	63.1%	5.7%	19.5%	11.7%
Microwave Oven	68.1%	7.1%	12.8%	12.0%
Room Air Conditioner	62.6%	18.0%	15.2%	4.1%

(Source: *Recycling, Waste Stream Management, and Material Composition of Major Home Appliances*, R.W. Beck and Weston Solutions for the Association of Home Appliance Manufacturers, October 2005)

## Overall Findings

*Recyclers are able to pass on the decline in metal prices to retailers and regional districts by paying a lower fee for EoL appliances. Therefore, the ability of recyclers to make a profit is not affected by metal prices, but their profit margins do benefit from higher prices.*

*In recent years, the proportion of plastics in major appliances has increased. Some recyclers have noted that they have seen an increase in the proportion of plastics in the recycling of major appliances. Although this does not currently appear to have a significant impact on the operations and profitability of recyclers, as the proportion of plastics in major appliances increases, this could have an impact on their total profit.*

## Summary Model

<b>Revenues</b>	
Sale of ferrous metal	10,704,762
Sale of non-ferrous metal	12,936,251
	<b>23,641,014</b>
Total cost	22,695,373
<b>Total profit (loss)</b>	<b>945,641</b>
<i>Expected profit margin</i>	<i>4.00%</i>

# Recyclers

## Revenue Drivers (continued)

- Given that most collectors do not track the EoL appliances by type, we have approximated the overall EoL appliance material mix based on the 2015 sales of major appliances in BC as reported by MARR members. This data indicates that approximately 800,000 major appliances would be recycled as a result of appliance replacements. MARR's 2015 annual report indicates an overall collection rate of 98.7%. This indicates that approximately 790,000 appliances were processed by recyclers. This translates into approximately 69,000 tonnes of EoL appliances.
- Based on the above, we have considered the following material mix and implied tonnage in our analysis:

Appliance Type	Composition	Tonnes
Ferrous Metal	67.7%	46,680
Non-Ferrous Metal	6.4%	4,400
Plastic	19.0%	13,144
Other	7.0%	4,825

As the proportion of plastics in major appliances increase, this could have an impact on the overall composition of EoL appliances. In the long-term, this could put downward pressures on the revenues available to recyclers from recycling EoL appliances.

- Recyclers indicate that 98% of the ferrous and non-ferrous materials are recovered and sold to end users. In pricing ferrous metals, we looked to average 2015 prices for various indices:

### Index (US\$ per tonne)

U.S. Midwest #1 Busheling Ferrous Scrap (AMM) Futures	250
Metal Bulletin Ferrous Scrap Index FOB Rotterdam HMS 1&2	217
<b>Average</b>	<b>234</b>

- The price of non-ferrous metals varies significantly depending on the composition of the non-ferrous metals. A review of the composition of various ODS and non-ODS appliances indicates that copper and aluminium are the primary non-ferrous metals contained in EoL appliances.

In pricing such metals, we considered the average 2015 prices for an index:

### Index (US\$ per tonne)

NNS Non-Ferrous Metals Copper Mixed Scrap	5,660
-------------------------------------------	-------

We also considered the current prices posted by various sources (including recycling companies in North America). Where various prices were posted for a type of non-ferrous metal, we considered an average of the relevant available prices:

Source (US\$ per LB)	Copper	Aluminum
CMC Recycling	1.98	0.52
Scrap Register	1.96	0.61
Scrap Metal Prices and Auctions	1.75	0.37
Acier Century Inc.	n/a	0.49
<b>Average (US\$ per LB)</b>	<b>1.90</b>	<b>0.50</b>
<b>Average (US\$ per tonne)</b>	<b>4,190</b>	<b>1,100</b>

Based on the above, and assuming that the mix of copper and aluminium is relatively even, we have utilized a non-ferrous metal price of US \$3,000 per tonne in our analysis. This gives consideration to the average index price and other source price above for copper.

- Based on discussions with recyclers, we understand that they do not generate revenues from other materials (including plastics). As such, no revenue has been attributed to other materials.



# Recyclers

## Cost Drivers

- Transportation cost:** The scrap metal prices used in our analysis reflect the cost of transporting the EoL appliances (usually by the recycler). Accordingly, we have included the transportation costs incurred by the recyclers as a cost item. Since, we were provided with limited direct information with respect to transportation cost, we have used indirect methods based on research and knowledge to arrive at an estimate, as follows:

Truckload rate (per kilometer) <sup>1</sup>	2.00
Tonnes per truckload	20
<b>Rate per tonne per kilometer</b>	<b>0.10</b>
Approximate distance transported <sup>2</sup>	300
Total tonnes processed <sup>3</sup>	69,000
Rate per tonne per kilometer	0.10
<b>Transportation cost</b>	<b>2,070,000</b>

1. Based on research of average truckload rates. Note that this rate varies significantly depending upon the transportation equipment used, whether the EoL appliances have been decommissioned and compacted / baled metal (depending on the other materials transported).

2. The distance that the recycler has to transport the appliances varies widely depending on the location of the collection sites of the regional districts and the retailer warehouses. After removing outliers, we have considered the average distance appliances were transported based on information provided by regional districts regarding the location of their collection sites and the recyclers that they utilize, giving consideration to the need for the recycler to make a round trip.

3. See first bullet point on Page 39 for discussion and analysis of total tonnes processed.

- Scrap metal cost:** One of the key costs paid by recyclers is the price of scrap metal paid to regional districts and recyclers for EoL appliances. We understand that this price is typically based on the American Metals Market monthly floating rate for the metals, less a fixed per tonne processing fee. In 2015, the average scrap metal price received by regional districts was \$40 per tonne before consideration of transportation costs. This implies total scrap metal costs of \$2,760,000 based on the tonnes of EoL appliances collected in 2015.

As noted previously, in recent years, the proportion of plastics in major appliances has increased. Some recyclers have noted that they have seen an increase in the proportion of plastics in the recycling of major appliances. However, recyclers typically pay for scrap metal on a consolidated basis. For example, scrap metal purchased from a regional district could be a combination of EoL appliances, automotive scrap and other scrap metal, and is paid for on a consolidated basis.

As a result, recyclers indicate that the increase in plastic in EoL appliances has not had an impact on the scrap metal prices they offer regional districts and other collectors, but this indicates that, on a per tonne basis, scrap metal from EoL appliances earn lower scrap metal revenues relative to other sources of scrap metal.

- Landfill cost:** The average cost to landfill material is based on the tipping fee charged by various landfills for plastic and other materials. The average tipping fee charged by the regional districts that we sampled is \$100/tonne. We have assumed that 2% of ferrous and non-ferrous materials and all plastic and other materials will have to be landfilled.



# Recyclers

## Cost Drivers (continued)

- **Equipment cost:** Similar to the transportation cost, many recyclers will bale EoL appliances at the regional districts before transporting them. As we have utilized scrap metal that reflect the cost of equipment required to bale EoL appliances, we have included equipment costs incurred by the recyclers as a cost item. Since, we were provided with limited direct information with respect to equipment cost, we have used indirect methods based on research and knowledge to arrive at an estimate, as follows;
  - Data provided by a regional district indicates that the cost for renting similar equipment ranges from \$100 to \$200 per hour. It has been estimated that, on average, that approximately 60 appliances can be baled per hour.
  - Based on the average weight of an appliance, this works out to approximately \$29/tonne of EoL appliances.
  - Based on the above, the total cost for the 69,000 tonnes of appliances processed by recyclers is \$2,001,000.
- **Processing cost:** Recyclers incur costs related to shredding the EoL appliances. There is limited data available with respect to processing costs for recyclers.

## Overall Profit (Loss)

- As previously discussed, there is limited data available with respect to some of the cost drivers, although we have estimated some of the costs individually. We have therefore used industry benchmarks, as presented by the Risk Management Association's Annual Statement Studies to determine the overall profitability for recyclers over a number of years, and used this data to imply the processing cost:

NAICS	2015 - 2016
562920 (Material Recovery Facilities)	6.4%
423930 (Recyclable Material Wholesalers)	2.1%

Discussions with recyclers suggests that recycling of EoL appliances results in similar or slightly lower profit margins than recycling of other scrap metal. A lower profit margin would result from higher proportions of waste (such as plastic and insulation) in EoL appliances.

Based on consideration of the above, we have applied a profit margin (earnings after consideration of depreciation, prior to income taxes) of 4% to this industry, which indicates that recyclers earned a profit (incurred a loss) of \$945,641 from collecting and recycling EoL appliances in 2015.

# Recyclers

## Sensitivity Analysis

- We performed an analysis in regards to the sensitivity of revenue and operating profit of recyclers to scrap metal prices. As previously discussed, the average revenues from scrap metal received by regional districts declined from \$100 / tonne in 2013 to \$40 / tonne in 2015.

- In 2013, the average price of the various indices was as follows:

<b>Index (US\$ per tonne)</b>	<b>Ferrous</b>	<b>Non-Ferrous</b>
U.S. Midwest #1 Busheling Ferrous Scrap (AMM) Futures	400	n/a
Metal Bulletin Ferrous Scrap Index FOB Rotterdam HMS 1&2	354	n/a
NNS Non-Ferrous Metals Copper Mixed Scrap	n/a	7,500
<b>Average</b>	<b>377</b>	<b>7,500</b>

- We estimated the total revenues in 2013, based on the above, to be \$34,388,237.
- Given the limited cost information available, we have performed an industry analysis, similar to our previous analysis:

<b>NAICS</b>	<b>2011 - 2012</b>	<b>2012 - 2013</b>	<b>2013 - 2014</b>	<b>2014 - 2015</b>	<b>2015 - 2016</b>
562920	7.7%	8.3%	6.4%	2.7%	6.4%
423930	4.3%	3.6%	2.0%	2.3%	2.1%

- We have applied a profit margin of 4% for 2013 (based on the 2013 – 2014 profit margins):

<b>Revenues</b>	
Sale of ferrous metal	17,246,562
Sale of non-ferrous metal	17,141,676
	<b>34,388,237</b>
Total cost	33,012,708
<b>Total profit (loss)</b>	<b>1,375,529</b>
<i>Expected profit margin</i>	<i>4.00%</i>

- The above analysis indicates that recyclers, as a whole, earned a profit (loss) of \$1,375,529 in 2013.
- The above suggests that the margins of recyclers are not significantly sensitive to the price of metal. This suggests that recyclers are able to maintain their margins under different price environments by passing on the fluctuations in pricing through their scrap metal price.

# *Rural and Remote Communities Study*

# Methodology

## Key Components

### 1. Physical space maps



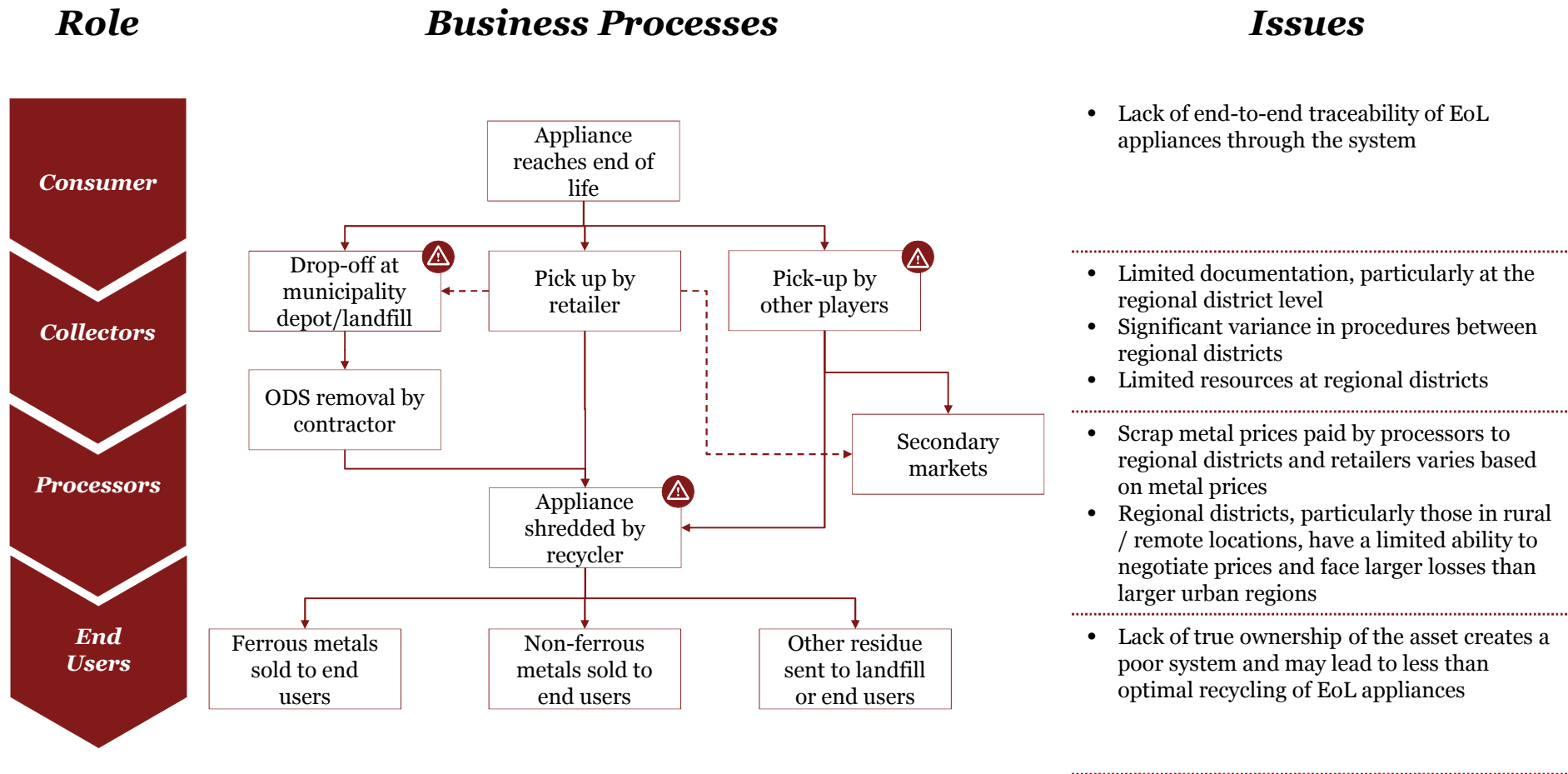
- The physical space maps help us to perform both a qualitative and quantitative analysis of the logistics.
- Detailed maps for each regional district are provided in Appendices 3 to 9.

### 2. Interviews

- Qualitative analysis to reconfigure the current role and activities.

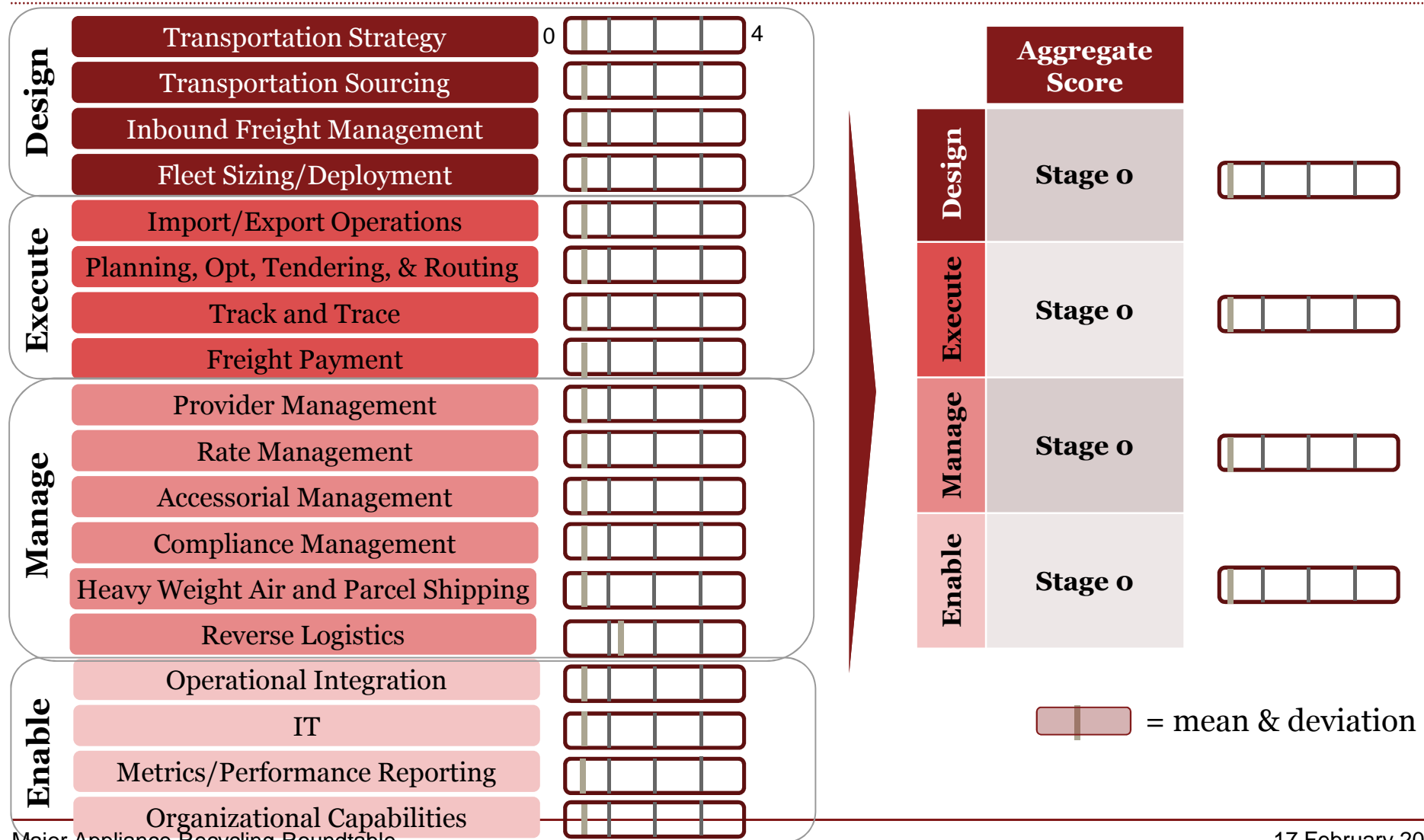
# Role and Activity Diagram

This tool helps us to better visualize the flow of materials and information with all the key touch points and issues related to the process.



# Transportation management maturity model framework

Current system and score is at stage 0 to 1 or not developed



# Detailed Observations

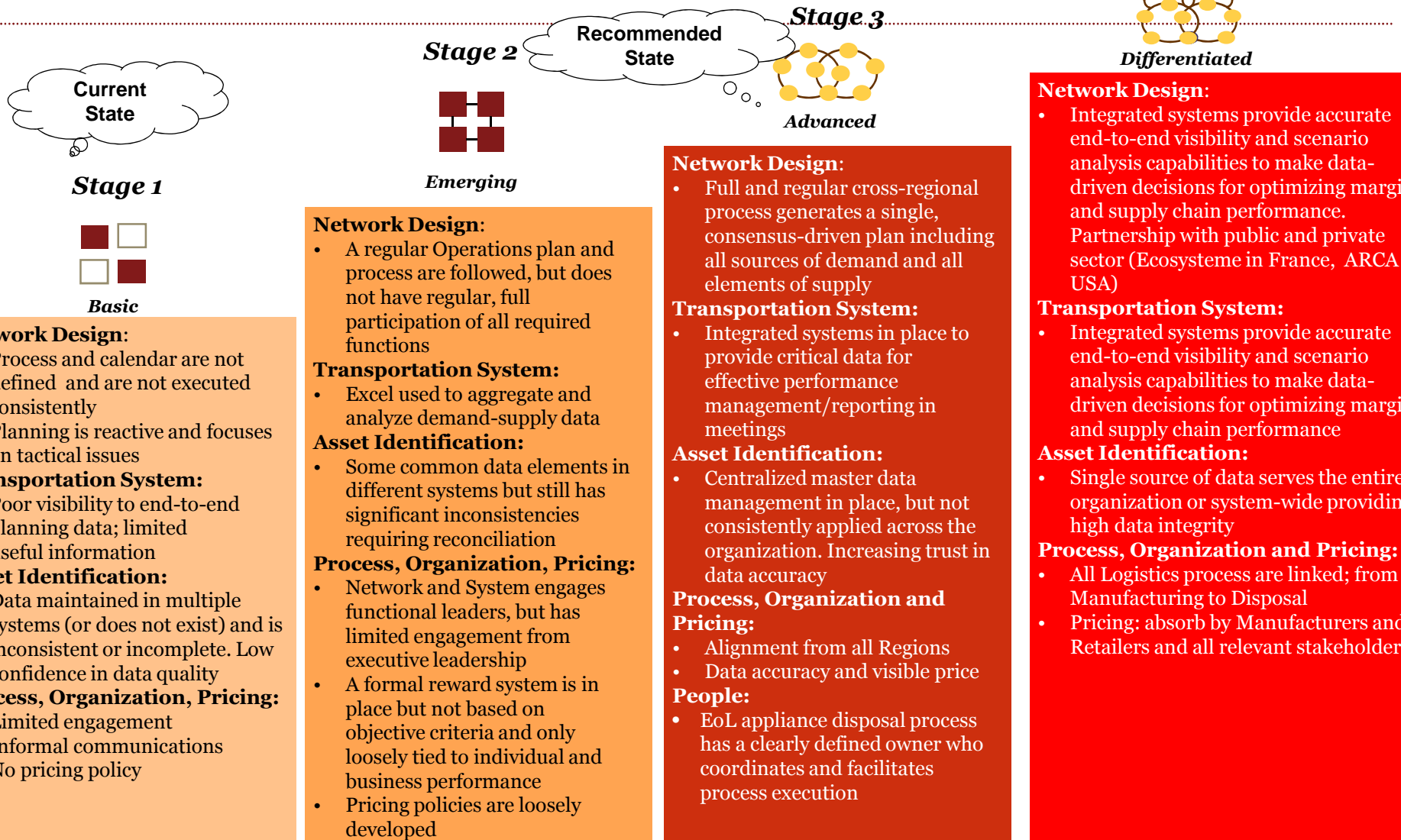
	Findings	Impact
Traceability	<ul style="list-style-type: none"> <li>There is a lack of end-to-end traceability of major appliance recycling through the system.</li> </ul>	<ul style="list-style-type: none"> <li>Almost impossible to quantify and qualify the life cycle of an appliance. There are too many holes and touch points with no verification and records.</li> <li>This is supported by the large number of differing data points with respect to the volume of EoL appliances recycled in 2015.</li> </ul>
Documentation	<ul style="list-style-type: none"> <li>There is limited documentation, particularly at the regional district level, regarding the major appliances collected and processed.</li> </ul>	<ul style="list-style-type: none"> <li>Leads to difficulties in identifying and remedying issues. The information flow (tracking all the paper work and controls, including price and weight) is not captured in systems.</li> </ul>
Regional Differences	<ul style="list-style-type: none"> <li>There are significant variations in the procedures for recycling major appliances between the various regional districts.                             <ul style="list-style-type: none"> <li>Some regional districts subcontract the operation of collection facilities, while others operate such facilities on their own.</li> <li>The time frame for sending major appliances to recyclers varies significantly from region to region.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>It is difficult to ensure that the system is fully efficient if there are significant differences between the regional districts.</li> </ul>

# Detailed Observations

	Findings	Impact
Pricing	<ul style="list-style-type: none"> <li>The price received by regional districts and retailers for scrap metal varies based on metal prices.</li> </ul>	<ul style="list-style-type: none"> <li>Regional districts may stockpile appliances until metal prices increase, leading to higher storage costs.</li> <li>The regional districts become the bottleneck for efficient recycling of major appliances</li> <li>A decline in metal prices negatively impacts revenues received by regional districts and retailers while their costs are generally fixed.</li> <li>Many regional districts and retailers operate at, or believe they operated at, a loss, leading to no incentive for players to recycle.</li> </ul>
Resource Requirements	<ul style="list-style-type: none"> <li>Regional districts who operate their own sites have limited resources available.</li> <li>Lack of true ownership of the asset creates a poor system and results in EoL appliances being disposed of outside of the system.</li> </ul>	<ul style="list-style-type: none"> <li>Inefficient processes and documentation.</li> <li>Assets are left in large yards and subject to vandalism</li> <li>Environmental hazards not measured</li> </ul>



# Capability Maturity Profile and Business Economic Model



# Summary of Current Business Model

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## Current State

### Characteristics

- Poor asset traceability and identification lead to revenue leakage
- Absence or not optimal standardized documentation system in place to record and trace the asset
- Regional differences: different logistics and business practices by regions
- Pricing difference between regions

# Alternative Business Models

*The European Union offers practices that can be applied to British Columbia*

## European Recycling Platform - Scandinavia

### Characteristics

- Clear directives and objectives developed by the European Union (WEEE directives) on recycling targets to achieve: *electronics and appliances*
- EoL recycling drop points across the entire counties for Consumers
- Local authorities involved but not owner
- Membership required: Manufacturers are heavily involved in the process and asset tracking
- Overhaul of appliances and reselling if in good shape
- Regional differences: different Logistics and business practices by regions
- Pricing difference between regions

## France - Ecosystemes

### Characteristics

- Private company with 11,500 drop points in France for appliances recycling
- Involved in overhaul and reselling of appliances
- Involved in recycling
- Ownership on transportation (various contracts)
- Centralized Logistics Planning and Scheduling system
- Non for profit organization
- Lead by 35 Manufacturers and Retailers (Aucan, Carrefour, Miele) – Major European private company players

# *Appendices*

	<b>Appendices</b>	<b>52</b>
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# *Glossary*

# *Glossary of Key Terms and Abbreviations*

<b>Reference</b>	<b>Description</b>
<b>BC</b>	British Columbia
<b>Collection sites</b>	Municipal recycling depots, transfer stations and landfills
<b>CRA</b>	Canada Revenue Agency
<b>EoL appliance</b>	A major appliance which has reached the end of its useful life.
<b>MARR</b>	The Major Appliance Recycling Roundtable of British Columbia
<b>ODS</b>	Ozone depleting substances
<b>Pick up fee</b>	Refers to the fee charged by retailers to consumers for picking up EoL appliances
<b>Regulation</b>	British Columbia's Recycling Regulation
<b>Tipping fee</b>	Refers to the fee charged by regional districts to consumers for disposing of EoL appliances at collection sites

# *Metro Vancouver*

# Metro Vancouver

## Background

- Metro Vancouver's integrated recycling and solid waste management system provides service to the residents and businesses of 21 municipalities, one Electoral Area and one Treaty First Nation.

## Interview Summary

- Metro Vancouver accepts appliances at 1 landfill, 5 transfer stations and 5 recycling depots. The transfer stations are operated by contractors – SSG operates 2 and WasteTech operates the remainder. The landfill and recycling depots are operated by the local municipalities.
- ODS removal is performed by a third party contractor for all of the Collection Sites.

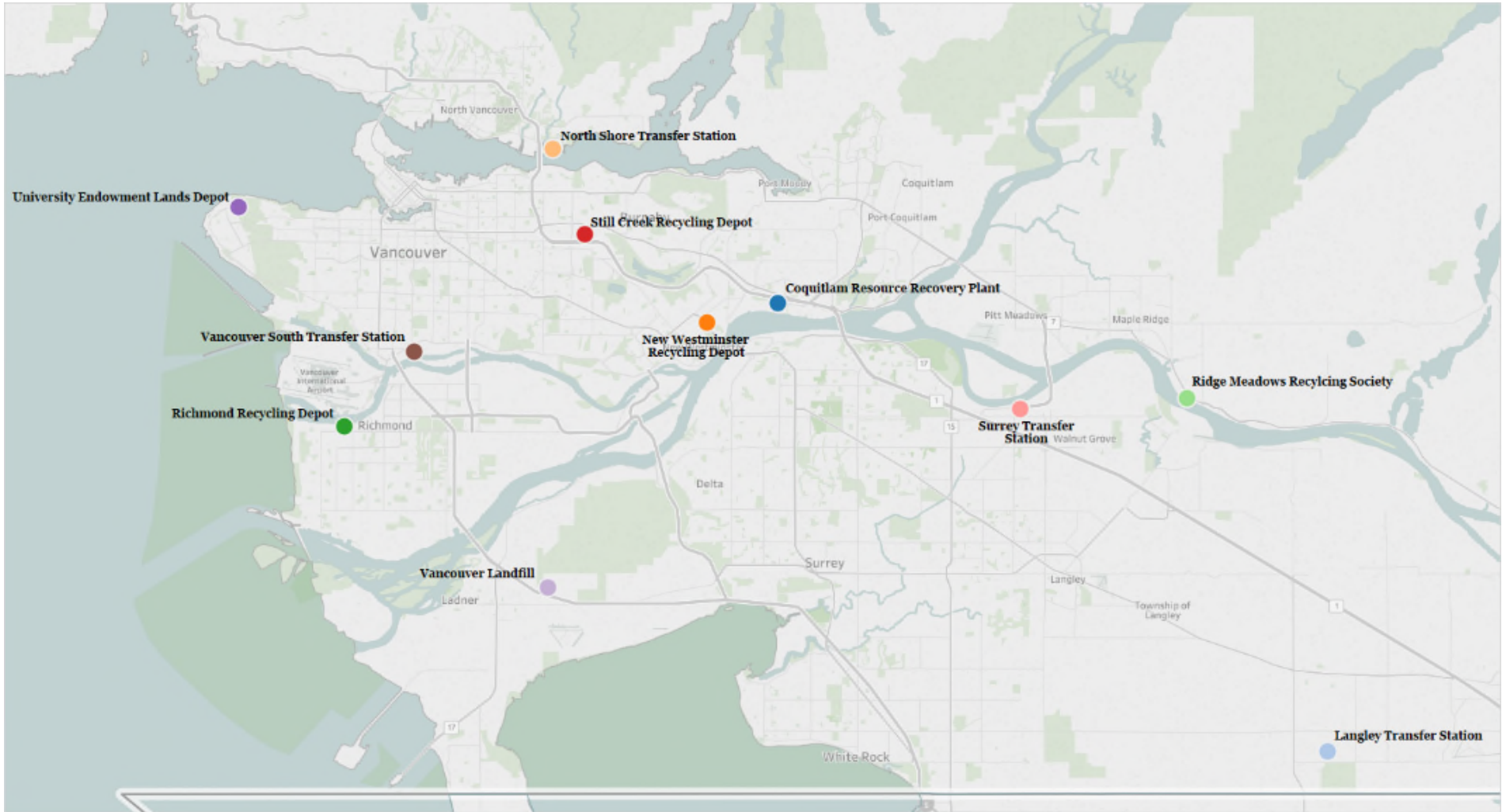
## Select Facts and Figures

<b>Population (2011 census)</b>	2,313,325
<b>Population density (per km<sup>2</sup>)</b>	802.5
<b>Collection sites</b>	11
• Landfills	1
• Transfer stations	5
• Recycling depots	5
<b>Population per collection site</b>	96,389
<b>Tonnes of appliances collected</b>	
• MARR 2015 annual report	11,525
• Estimated by regional district <sup>1</sup>	n/a
<b>ODS appliances collected in 2015</b>	19,513
<b>Tipping fee – ODS appliances</b>	\$nil
<b>Tipping fee – non-ODS appliances</b>	\$nil

<sup>1</sup> Data not provided by Metro Vancouver.



# *Metro Vancouver Map of Collection Sites*



# *Capital Region*

# Capital Region

## Background

- The Capital Regional District (“CRD”) is the regional government for the 13 municipalities and three electoral areas located on the southern tip of Vancouver Island.
- The urban centre of the CRD is the City of Victoria, and the regional district also includes many Gulf Islands, a number of rural municipalities and a vast tract of wilderness that lies along the southwestern coast of Vancouver Island.
- Appliances in the CRD are collected through a landfill in Victoria and a transfer station in Port Renfrew, except in the Gulf Islands. Appliances on the Gulf Islands are collected through local societies.

## Interview Summary

- Removal of ODS at the landfill in Victoria is subcontracted out (and occurs approximately twice a month), and the resulting appliances are transported to Schnitzer Steel through a third party contract. On average, appliances are transported to Schnitzer Steel two to three times per week (dependent upon the volume of appliances received). The CRD indicates that revenues for the sale of scrap metal are consumed by the cost of transporting the appliances.
- Appliances from Port Renfrew (14 times per year) and the Gulf Islands are transported to Schnitzer Steel, where ODS is removed.

## Select Facts and Figures

<b>Population (2011 census)</b>	359,990
<b>Population density (per km<sup>2</sup>)</b>	153.8
<b>Collection sites<sup>1</sup></b>	2
• <b>Landfills</b>	1
• <b>Transfer stations</b>	1
<b>Population per collection site</b>	180,000
<b>Tonnes of appliances collected</b>	
• <b>MARR 2015 annual report</b>	1,571
• <b>Estimated by regional district in 2014</b>	140
<b>ODS appliances collected in 2015<sup>2</sup></b>	n/a
<b>Tipping fee – ODS appliances</b>	\$15.00 / appliance
<b>Tipping fee – non-ODS appliances</b>	\$nil

<sup>1</sup> Excludes consideration of Gulf Islands as they are not run by the CRD.

<sup>2</sup> Data for 2015 is not available. 1,498 ODS appliances were collected at the Hartland landfill in 2014.

# Capital Region

## Material Flow From Collection Sites to Recyclers



### Findings:

- Transportation is outsourced to Emterra Environmental

### Frequency of removal in 2015:

- Hartland Landfill: 2-3 times / week
- Port Renfrew Transfer Station: 14

# ***Bulkley- Nechako***

# Bulkley-Nechako

## Background

- The Regional District of Bulkley-Nechako (“RDBN”) comprises 8 municipalities in central British Columbia.
- The RDBN environmental services department is responsible for administering the recycling programme across all 8 municipalities.

## Interview Summary

- Major appliances are accepted at a number of landfills and transfer stations.
- A contractor is hired to remove ODS once or twice a year; the tipping fee for ODS appliances is intended to cover this cost.
- Every two years, the RDBN will arrange for the removal of scrap metal through a Request for Quotation. Historically, Richmond Steel and Schnitzer Steel have contracted with the RDBN for scrap metal removal.
- It takes two years for the RDBN to stockpile scrap metal to accumulate sufficient volumes to maximize the economic viability of recycling.
- The price that RDBN receives for scrap metal dropped from \$165 / metric tonne to \$20 / metric tonne from 2011 to 2016 due to the price of scrap metal. Prior to 2011, RDBN did not receive any revenue from recycled metal – contracts were on a no cost / no revenue basis.

## Select Facts and Figures

<b>Population (2011 census)</b>	39,210
<b>Population density (per km<sup>2</sup>)</b>	0.5
<b>Collection sites</b>	8
• Landfills	1
• Transfer stations	7
<b>Population per collection site</b>	4,900
<b>Tonnes of appliances collected</b>	
• MARR 2015 annual report	298
• Estimated by regional district <sup>1</sup>	n/a
<b>ODS appliances collected in 2015</b>	1,333
<b>Tipping fee – ODS appliances</b>	\$16.00 / appliance
<b>Tipping fee – non-ODS appliances</b>	\$nil

<sup>1</sup> The regional district does not keep records of non-ODS appliances

# Bulkley-Nechako

## Material Flow From Collection Sites to Recyclers



Distance from	Richmond Steel	Schnitzer Steel
Fort St. James Transfer Station	160 km	922 km
Vanderhoof Transfer Station	98 km	859 km
Area 'D' Transfer Station	164 km	926 km
Southside Transfer Station	280 km	1,041 km
Burns Lake Transfer Station	231 km	993 km
Simthers-Telkwa Transfer Station	361 km	1,122 km
Knockholt Sub-Regional Landfill	305 km	1,066 km
Granisle Transfer Station	318 km	1,079 km

### Findings:

- ODS removal is performed once or twice a year at the transfer station / landfill before the appliances are transferred to the scrap metal pile
- The ODS remover comes from a distance away to perform this work
- The RDBN will contract a recycler every two years to recycle the scrap metal, through a RFQ process. The price that the RDBN gets is for all scrap metal, including non-EoL appliances. There is the potential that the EoL appliances are worth less than other scrap metal, but are getting the benefit of the price that other scrap metal would typically fetch.

# *Kootenay Boundary*



# Kootenay Boundary

## Background

- The regional district of Kootenay Boundary (“RDKB”) is made up of eight municipalities and five electoral areas in southern British Columbia.
- The RDKB provides recycling programs, transfer stations, landfills, and education on Reduce and Reuse opportunities.
- The waste stream for major appliances represents less than 1% of the total waste stream weight, however the volume amount is much larger.

## Interview Summary

- EoL appliances are regulated in British Columbia; municipalities are not encouraged to tax the collection and recycling of EoL appliances.
- RDKB does not count or weight non-ODS appliances.
- Scrap gets collected by the recycler when sizeable for recycling; the timing varies depending on the landfill and/or transfer station.
  - At the McKelvey Creek Landfill and Grand Forks Landfill, this occurs when there are 2 x 40 yard bins of scrap metal.
  - At transfer stations, this occurs at least once per year, or at capacity.
- EoL appliance recycling margins is dependent upon the scrap metal market, but goal is to achieve full cost recovery (i.e. net zero).

## Select Facts and Figures

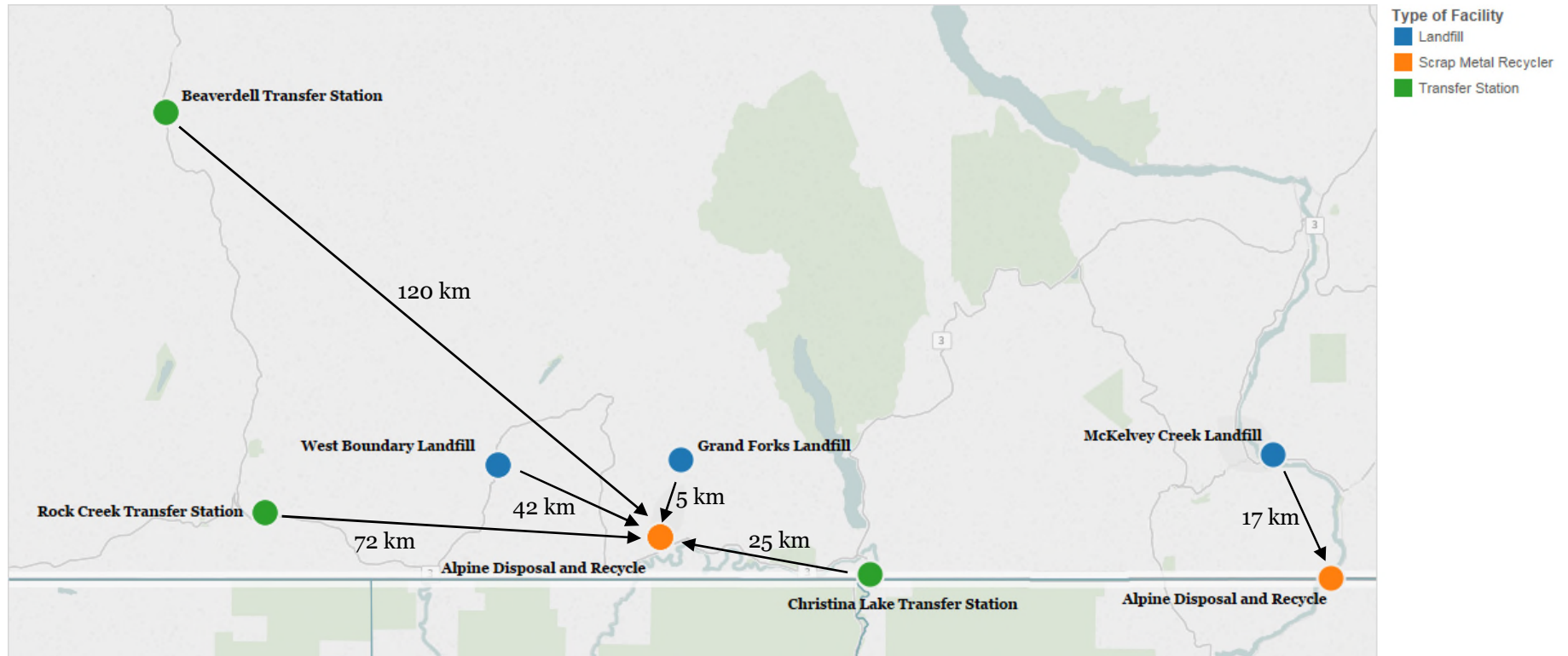
<b>Population (2011 census)</b>	31,135
<b>Population density (per km<sup>2</sup>)</b>	3.9
<b>Collection sites</b>	6
• Landfills <sup>1</sup>	3
• Transfer stations	3
<b>Population per collection site</b>	5,190
<b>Tonnes of appliances collected</b>	
• MARR 2015 annual report	193
• Estimated by regional district	1,000
<b>ODS appliances collected in 2015</b>	~ 1,400
<b>Tipping fee – ODS appliances</b>	\$20 / appliance
<b>Tipping fee – non-ODS appliances<sup>2</sup></b>	
• Scaled sites	\$15.00 / tonne
• Non-scaled sites	\$5.00 / cubic metre

<sup>1</sup> One of the landfills does not accept ODS appliances

<sup>2</sup> Charge for non-ODS appliances represents a tipping fee and is the same as other scrap metal

# Kootenay Boundary

## Material Flow From Collection Sites to Recyclers



### Findings:

- ODS removal is performed at the landfills / transfer stations prior to transfer of appliances to Alpine
- Transportation is outsourced to Alpine
- Scrap is sent to the recycler when sizeable

### Frequency of removal in 2015:

- Grand Forks Landfill: 6
- West Boundary Landfill: 1
- Rock Creek Transfer Station: 2
- Christina Lake Transfer Station: 4
- McKelvey Creek Landfill: > 100
- Beaverdell Transfer Station: 1

# *Mount Waddington*

# Mount Waddington

## Background

- The Regional District of Mount Waddington (“RDMW”) is the governing body that provides local services, planning, solid waste, parks, and economic and tourism development services for the residents of Northern Vancouver Island and part of B.C.’s mainland coast.
- The RDMW encompasses a number of settlements, including the municipalities of Alert Bay, Port Alice, Port Hardy and Port McNeill.

## Interview Summary

- Residents of the RDMW can drop off EoL appliances at either the 7 Mile Landfill or the Malcolm Island Recycling Depot or Woss Transfer Station. The RDMW does not charge a fee for EoL appliances, irrespective of whether they contain ODS.
- Retailers also collect appliances in the RDMW, which they drop off at the 7 Mile Landfill.

## Select Facts and Figures

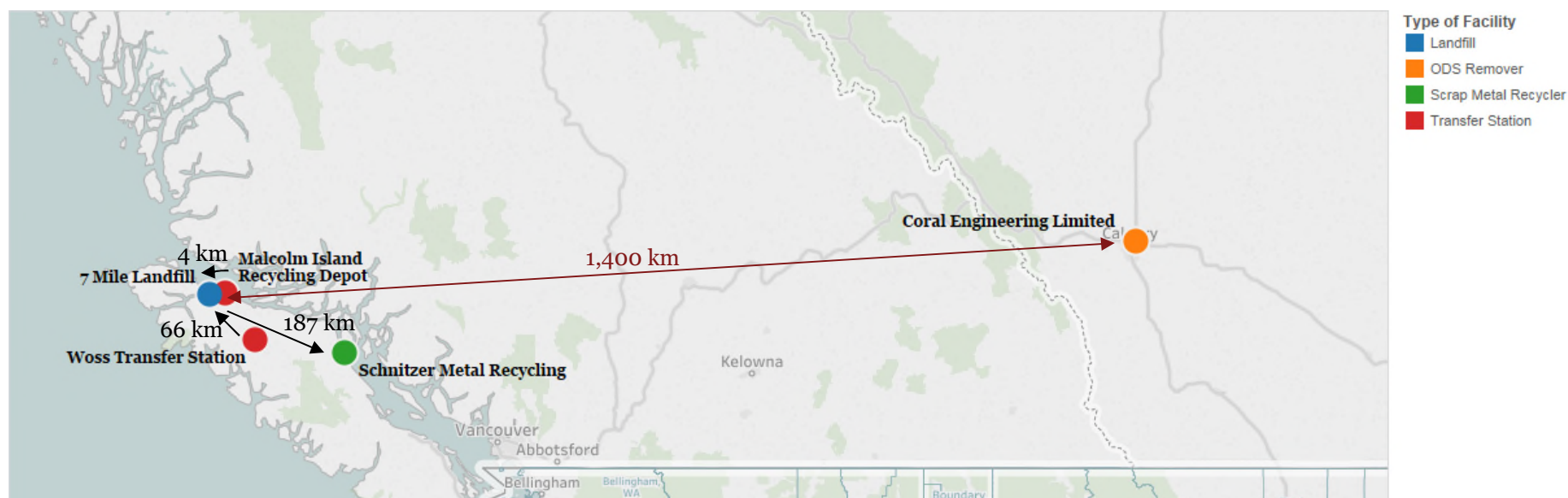
<b>Population (2011 census)</b>	11,505
<b>Population density (per km<sup>2</sup>)</b>	0.6
<b>Collection sites</b>	3
• Landfills	1
• Transfer stations	2
<b>Population per collection site</b>	3,835
<b>Tonnes of appliances collected</b>	
• MARR 2015 annual report	66
• Estimated by regional district <sup>1</sup>	191
<b>ODS appliances collected in 2015</b>	167
<b>Tipping fee – ODS appliances<sup>2</sup></b>	\$nil
<b>Tipping fee – non-ODS appliances<sup>2</sup></b>	\$nil

<sup>1</sup> Reflects 2014 data as the RDMW tracks metal going out of the landfill; in 2015, all scrap metal was retained due to low prices

<sup>2</sup> The RDMW’s website indicates that the RDMW accepts both ODS and non-ODS appliances without charge

# Mount Waddington

## Material Flow From Collection Sites to Recyclers



### Findings:

- EoL appliances collected at the Malcolm Island Recycling Depot and Woss Transfer Station are transported to 7 Mile Landfill
- The transport of appliances from the Malcolm Island Recycling Depot to 7 Mile Landfill requires the use of an over-water means of transport (such as a ferry)
- An ODS remover from Coral Engineering Limited travelled to 7 Mile Landfill 3 times in 2015 to drain ODS from the relevant appliances
- The sale of scrap metal to Schnitzer Metal is based on price and accumulated volume – there is no set threshold for the sale of scrap metal
- When the RDMW decides to sell scrap metal, they will canvass metal recyclers to determine the best price. However, we note that, historically, the RDMW has sold their scrap metal to Schnitzer Metal Recycling.

# *Thompson Nicola*

# Thompson Nicola

## Background

- The Thompson Nicola Regional District (“TNRD”) consists of 11 municipalities and various electoral areas, and is located in interior British Columbia northwest of Vancouver.
- The regional manages the TNRD Solid Waste and Recycling programs throughout the TNRD with the exception of the City of Kamloops and Barnhartvale landfills, and the Cache Creek Landfill which are operated by the City of Kamloops and Wastech respectively.

## Interview Summary

- The TNRD does not pick up appliances, but there are 16 collection sites which will accept appliances for drop-off.
- Activities such as ODS removal, transportation and maintenance of eco depots are outsourced to private players.
- Once 20 to 40 ODS-containing appliances are collected, a private service provide is called to provide ODS removal. Scrap is collected from eco depots by recyclers “when sizeable”.
- The TNRD believes that the price received from the recycler is insufficient to cover the cost incurred for ODS removal and storage of appliances.

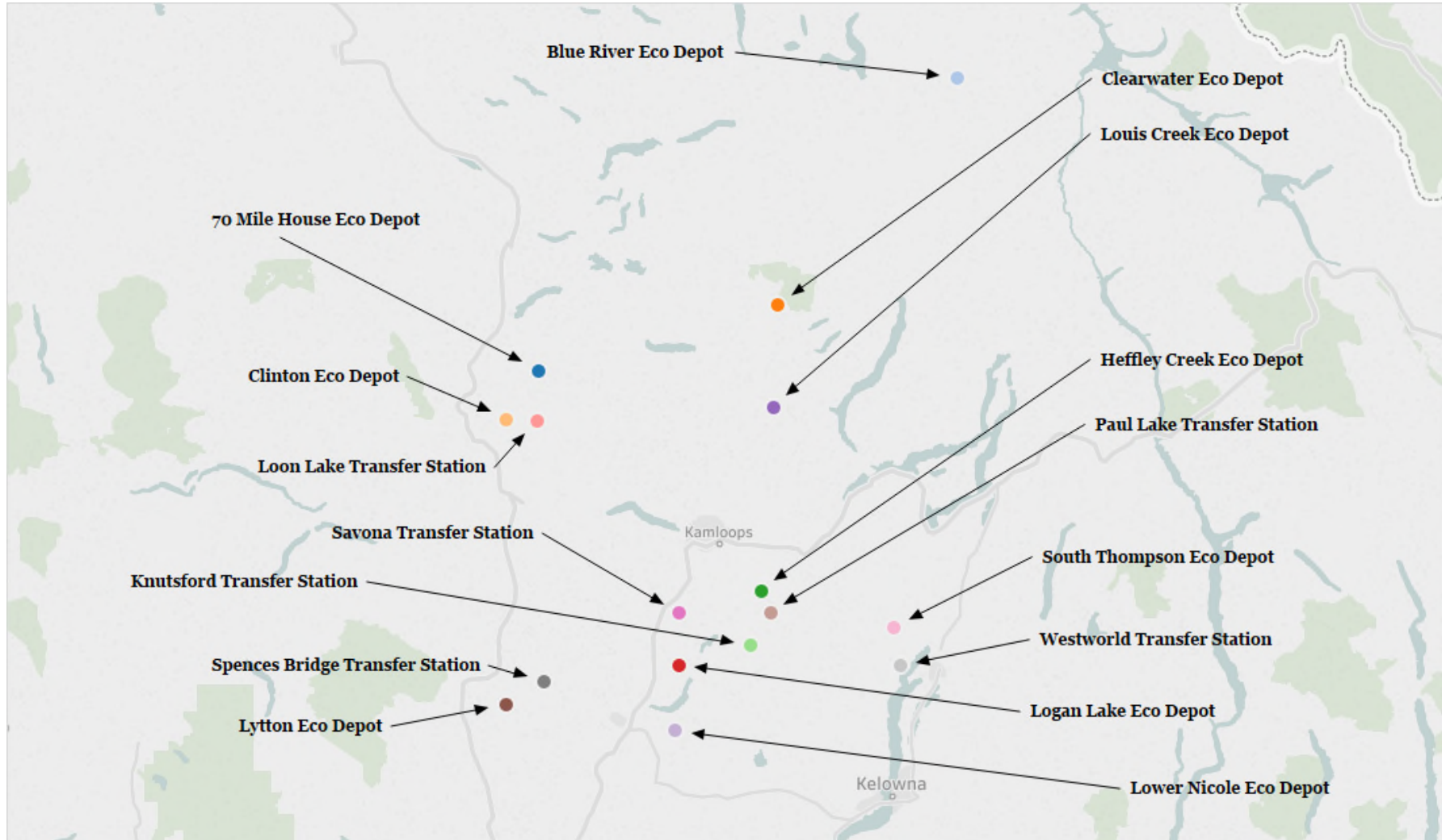
## Select Facts and Figures

<b>Population (2011 census)</b>	128,475
<b>Population density (per km<sup>2</sup>)</b>	2.9
<b>Collection sites</b>	16
• Landfills	0
• Transfer stations	16
<b>Population per collection site</b>	8,030
<b>Tonnes of appliances collected</b>	
• MARR 2015 annual report	674
• Estimated by regional district <sup>1</sup>	n/a
<b>ODS appliances collected in 2015<sup>1</sup></b>	n/a
<b>Tipping fee – ODS appliances</b>	\$15
<b>Tipping fee – non-ODS appliances</b>	\$nil

<sup>1</sup> Detailed data was not provided by the regional district



# Thompson Nicola Map of Collection Sites





# *North Okanagan*

# North Okanagan

## Background

- The Regional District of North Okanagan (“RDNO”) is comprised of six municipalities and five electoral areas.
- The RDNO manages the solid waste function in North Okanagan.

## Interview Summary

- ODS is removed from EoL appliances at North Okanagan collection sites approximately 3 times per year.
- The loader takes the appliances / scrap metal and puts it in a pile – at some sites, it is organized in bins.
- The collection sites are space restricted and will send out a request for quote at certain levels. Due to the space restriction, the RDNO cannot stockpile scrap metals in the low metal price environment.

## Select Facts and Figures

<b>Population (2011 census)</b>	11,505
<b>Population density (per km<sup>2</sup>)</b>	0.6
<b>Collection sites</b>	3
• Landfills	1
• Transfer stations	2
<b>Population per collection site</b>	3,835
<b>Tonnes of appliances collected</b>	
• MARR 2015 annual report	66
• Estimated by regional district <sup>1</sup>	n/a
<b>ODS appliances collected in 2014</b>	1,931
<b>Tipping fee – ODS appliances</b>	\$15
<b>Tipping fee – non-ODS appliances<sup>2</sup></b>	\$5

<sup>1</sup> The RDNO has not provided an estimate of the appliances collected by tonnes but estimates that 3,288 EoL appliances were collected in 2013.

<sup>2</sup> Based on the minimum charge for scrap metal.

# *North Okanagan Map of Collection Sites*

