Improving the Management of End-of-life Vehicles in Canada

April 2011

Acknowledgements

This report was written for the Canadian Environmental Law Association (CELA) by Anne Wordsworth, assisted by Sarah Miller. CELA is an Ontario legal aid clinic that provides legal services to low-income people and advocates for the application and improvement of environmental legislation.

CELA would like to thank the Canadian Auto Workers for their financial support and their advisory role in the development and review of this report. CELA would also like to thank Susan Sawyer-Beaulieu of the University of Windsor, Steven Fletcher of the Auto Recyclers of Canada and John Jackson of Great Lakes United for sharing their knowledge and experience of this issue and for their invaluable help in correcting and editing this report.

CELA Publication: 784

Cover photo is “Tipping Painted Cars” taken at Cadillac Ranch, Armadillo by Richie Diesterheft, Chicago, Illinois.

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Part I: The Situation in Canada and Ontario

1. Introduction

In Canada, approximately 1.2 million vehicles are taken off the road every year.[1] About 600,000 of these are retired in Ontario.[2] This creates more than 150,000 tonnes of vehicle waste – some of it contaminated – that goes to the province's landfill sites every year. However, despite the magnitude of the waste problem posed by these end-of-life vehicles, governments have paid little attention to their eventual fate.

Canada and the provinces have lagged behind many jurisdictions in the world in addressing this issue. However, new initiatives are now being proposed by both federal and provincial governments. An end-of-life vehicle (ELV) is a vehicle that is being taken out of use, either because of its age or because of damage from a collision.

On the national level, in October 2009 the Canadian Council of Ministers of the Environment approved a Canada-Wide Action Plan for Extended Producer Responsibility.[3] Under the terms of the Action Plan, the federal government and the provinces have made a commitment to developing framework legislation to manage a number of products and materials within 6 years.[4] Although the Action Plan does not specifically include end-of-life vehicles, the plan does include automotive products, such as used oil, filters, batteries, refrigerants, brakes and transmission fluids.

In addition, several provinces have been exploring initiatives that would result in better management of end-of-life vehicles.[5] Currently, the Ontario government is reviewing its *Waste Diversion Act*, 2002, and is considering the problem of end-of-life vehicles as part of this review. This Act is the province's principle legislation for the reduction, reuse and recycling of waste through waste diversion programs.

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[1] Personal Interview with Steve Fletcher, Auto Recyclers of Canada, November 17, 2009.
[2] Ibid. See Section 3 for an explanation of this estimate.
[3] Canadian Council of Ministers of the Environment, "Extended Producer Responsibility". Accessible at www.ccme.ca
[4] Canadian Council of Ministers of the Environment, "Backgrounder: A Canada-Wide Action Plan for Extended Producer Responsibility".
[5] Crittenden, Guy, "Producer Responsibility for Ontario and Quebec", Solid Waste & Recycling", December 1, 2009. Quebec released three draft regulations that would increase industrial responsibility for waste products.

Ontario has proposed a schedule that would make end-of-life vehicles a designated material for diversion within five years.[6] This would likely impose requirements for registration, planning and data submission on vehicle manufacturers and importers, and would include diversion targets.

It is also considering the idea of making "extended producer responsibility" the foundation for Ontario's waste disposal framework. If this were adopted, the responsibilities of vehicle manufacturers and importers would be extended to include managing the wastes associated with their products.[7]

2. Purpose

As a result of the current interest in addressing end-of-life vehicles in Canada and in Ontario, the Canadian Environmental Law Association, with the assistance of the Canadian Auto Workers, has prepared this report to examine the issues as they affect workers and the environment, and to recommend direction to the federal and provincial governments with respect to future laws and policies in order to maximize waste reduction and diversion from landfill.

This report is not intended to be a detailed or comprehensive analysis. Rather, it represents a snapshot of the current state of ELVs in Canada with recommendations for improvement. With respect to the management of end-of-life vehicles as for all products, it is assumed that waste policies and practices should be developed in a way that achieves the goals of reducing, reusing and recycling materials, in that order, to the greatest possible extent.

3. The Fate of Retired Vehicles in Canada and Ontario

In Canada, there has been no framework established for managing end-of-life vehicles at a national level, and there is no agency that tracks their numbers and how they are handled.[8] Of all the provinces, only British Columbia has put in place some requirements for managing ELVs. Consequently, it is very difficult to gauge the extent of the waste problem. Moreover, end-of-life is the least studied phase of the vehicle life-cycle.[9]

Although exact figures are not available, the Automotive Recyclers of Canada (ARC) estimate that every year 600,000 cars and other vehicles come off the

[6] Ontario Ministry of the Environment, "From Waste to Worth: The Role of Waste Diversion in the Green Economy", October 2009.
[7] Ibid. p.23.
[8] Gold, David, "End of the Road", Collision Repair, May/June 2004, p. 44.
[9] Sawyer-Beaulieu, Susan and Edwin K.L. Tam, Constructing a Gate-to-Gate Life Cycle Inventory (LCI) of End-of-Life Vehicle (ELV) Dismantling and Shredding Processes, University of Windsor, 2008.

roads in Ontario.[10] This represents just under half of the vehicles in Canada. This estimate is based on registration data which shows that 45% of national vehicle registrations are in Ontario, and takes into account the longer use of vehicles in British Columbia. Canada-wide, about 1.2 million vehicles are retired each year.[11]

ARC represents hundreds of auto dismantling and recycling facilities across Canada whose primary business is the sale of used auto parts. According to ARC, of Ontario's 600,000 end-of-life vehicles, approximately 200,000 are handled by their members.[12] Auto recyclers, who are members of the Ontario chapter of ARC, must comply with an Ontario Certified Auto Recycler Standard, which requires vehicles to be depolluted prior to shredding. The other 400,000 vehicles, roughly 65% of the total, are processed by other auto wreckers, some of whom sell used parts, or they go to salvage yards and scrap metal dealers that process vehicles for metal recovery. It is not known how many of these 400,000 vehicles are depolluted.

4. Auto Parts Recovery and Recycling

If a vehicle is taken to an auto recycler, the parts that can be recycled or used to replace parts in other vehicles will be removed before the vehicle is sent to a shredding operation. With the assistance of computerized databases, recovered parts will be sold for direct reuse, for remanufacturing and reuse, or for recycling.

Parts that can be recovered for reuse or remanufacturing include AC compressors, water pumps, carburetors, calipers, power steering pumps, carrier assembly, alternator, starters, transmissions, axle assemblies, engines, and transfer cases.[13] Engines and calipers, in particular, may be remanufactured and reused. Batteries, catalytic converters, radiators and tires are also removed from end-of-life vehicles for recycling.

Susan Sawyer-Beaulieu, Ph.D., from the University of Windsor, in her detailed research on the vehicle end-of-life (VEOL), found that reuse of vehicle parts may account for almost 6% by weight of end-of-life vehicles in Canada, parts remanufacturing about 0.1% by weight, and parts recycling almost 4% by weight.[14]

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[10] Personal Interview with Steve Fletcher, Auto Recyclers of Canada, November 17, 2009.
[11] This is a projection from Ontario figures.
[12] Personal Interview with Steve Fletcher, Auto Recyclers of Canada, Nov. 17, 2009. ARC estimates that 200,000 vehicles are handled by members of the organization and another 150,000 by known operators.
[13] Sawyer-Beaulieu, Susan and Edwin K.L. Tam, Constructing a Gate-to-Gate Life Cycle Inventory (LCI) of End-of-Life Vehicle (ELV) Dismantling and Shredding Processes, SAE Technical Paper Series, 2008-01-1283, April 2008.
[14] Sawyer-Beaulieu, Susan, 2009. Gate-To-Gate Life Cycle Inventory Assessment of North American End-Of-Life Vehicle Management Processes - Studying Vehicle End-of-Life (VEOL) Using Life Cycle Assessment (LCA), Information sheet, University of Windsor, 2 pgs.

The following chart shows the way in which ELVs are generally managed:

Retired Vehicles (Old End-of-life Vehicles and Premature End-of-life Vehicles from Accidents)	
Depollution (remove battery, fluids, tires, mercury switches, ozone-depleting substances, airbags)	Reuse (batteries, fuel, fluids such as antifreeze and windshield washing fluid, tires, ozone-depleting substances) Recycling (batteries, fluids, tires, ozone-depleting substances)
Dismantling (remove parts/materials)	Reuse of parts Remanufacturing of parts Recycling of materials
Shredding (shred vehicle, reclaim metal)	Recovery of metals
Landfill Shredder Residue	

Table 1. Current Management of End-of-life Vehicles

In addition to removing reusable and remanufacturable parts, auto recyclers play an important role in the removal of liquids that would otherwise become a pollution problem. When vehicles go for dismantling, liquids, including hazardous ones, are recovered either for reuse, recycling or for disposal. Fluids like gasoline, antifreeze, refrigerants such as chlorofluorocarbons, and windshield washing fluids will be recovered usually for reuse, while oils – engine oil, transmission, brake and steering fluid -- are recovered for recycling or disposal.[15]

An average of 19 litres of operating fluids is recovered in a proper depolluting

[15] Sawyer-Beaulieu and Edwin K.L. Tam, Constructing a Gate-to-gate Life Cycle Inventory (LCI) of End-of-Life Vehicle (ELV) Dismantling and Shredding Processes, SAE Technical Paper Series, 2008-01-1283, April 2008.

process.[16] According to Sawyer-Beaulieu's research, recovered fluids represent approximately 2% by weight of end-of-life vehicles in Canada.[17] They are:

Engine Oil	2.6 litres
Transmission Oil	1.3 litres
Drive Oil	1.1 litres
Steering Fluid	0.8 litres
Coolant/Antifreeze	2.8 litres
Fuel	10.4 litres

Reputable auto recyclers will also remove mercury lighting switches and mercury-containing anti-lock brake systems, and ensure the proper disposal of the mercury before a vehicle goes for shredding. Plastic fuel tanks are also removed and sent for disposal.

Therefore, when ELVs are handled according to industry standards, the reuse, recycling and recovery of vehicle parts and fluids may amount to as much as 12% of the vehicle by weight. However, if parts and fluids are *not* recovered, the residual waste will be contaminated, and a much higher percentage of the vehicle becomes landfill waste.

5. Shredding

After auto recyclers are finished dismantling a car and recovering parts, it is flattened and compressed, and directed to a shredder for scrap metal recovery. Along with ELVs, shredders process other metals-rich scrap, such as construction and demolition waste, and large end-of-life appliances (i.e. white goods).[18] During the shredding process, the vehicle is broken down into much smaller pieces, and the metals are extracted. Both ferrous metals – iron and steel – and non-ferrous metals, such as copper, zinc and aluminum, are recovered. Ferrous metals make up about 70% of a vehicle, while non-ferrous metals make up about 6%. There are five shredders in Ontario.

The amount of recyclable material, then, that is removed from an end-of-life vehicle via shredding is generally calculated to be about 75% by weight. By far, the greatest percentage by weight of recycled material is the scrap metal.

[16] Ontario Automotive Recyclers Association at www.oara.com
[17] Sawyer-Beaulieu, Susan, 2009. Gate-To-Gate Life Cycle Inventory Assessment of North American End-Of-Life Vehicle Management Processes - Studying Vehicle End-of-Life (VEOL) Using Life Cycle Assessment (LCA), Information sheet, University of Windsor, 2 pgs.
[18] Sawyer-Beaulieu, Susan and Edwin Tam, 2005. Applying Life Cycle Assessment (LCA) to North American End-of-Life Vehicle (ELV) Management Processes, SAE Technical Paper Series, 2005-01-0846, 11 pgs., (April).

However, because this estimate of 75% does not take into account the parts, and materials recovered by dismantlers, it may be an underestimate of the percentage by weight of materials recovered for recycling and reuse.[19] **Therefore, it is possible that some Canadian auto recyclers are already recovering as much as 85% of end-of-life vehicles by weight.**

However, if we take 75% as a rough calculation of the weight of a vehicle that is currently being recycled, the residual 25%, which is left after metals are removed from the shredded vehicle, becomes waste and is sent to landfill. This 25%, known as shredder residue (SR), is generally a commingled mix of rubber, plastics, glass, dirt, carpet fibres, and seat foam, as shown below.

Material	Percentage
Plastics – polyurethane foam, polyester, polypropylene, polyvinyl chloride, styrene, polyethylene, acrylic (includes hard plastics such as bumpers and dashboards, plastics in airbags and seatbelts and carpeting fabric)	15 – 25 %
Inert material (gravel, sand, dirt, etc.)	15 – 25 %
Paper/Wood	15 – 25 %
Glass	10 – 15 %
Rubber	10 – 15 %
Moisture	10 – 15 %

Table 2. Composition of Auto Shredder Residue[20]

If 600,000 vehicles in Ontario are retired each year, they generate at least 500 pounds of auto shredder residue per vehicle. This amounts to 300 million pounds (or 150,000 tons) of vehicle waste going into landfills each year.

If the end-of-life vehicle is not initially taken to an auto recycling facility, it will most likely go to a scrap metal dealer or salvage yard. When this route is taken, the vehicle is not dismantled for parts. Further, it is not known whether the

[19] Personal Communication with Susan Sawyer-Beaulieu, University of Windsor, on December 10, 2009.
[20] The source of this information is given as Brett Richards, Co-Steel Recycling, Whitby, Ontario, 1999 on the Auto Recyclers of Canada website "What is an end of life vehicle?" at www.1877endoflifevehicles.com

vehicle will be depolluted or not since it may not be feasible, physically or economically, for facilities to remove windshield washer fluids, refrigerants and other polluting substances from the vehicle before it is shredded. If the vehicle is not depolluted prior to being shredded, the shredder residue that is generated and directed to landfill will likely be more contaminated than shredder residue generated from an ELV that is depolluted first.

The situation in Canada has been improved recently by the federal Retire Your Ride program, which offers vehicle owners $300 if they turn in a vehicle manufactured before 1995 for recycling. This program, which ended March 2011, requires owners to leave their vehicles with auto recycling operations that meet certain protocols for dismantling the vehicle. A National Code of Practice for Automotive Recyclers was developed for Environment Canada by ARC, and recyclers participating in the Retire Your Ride Program are audited by an independent third party paid for by Environment Canada.[21]

This program has had the effect, then, of diverting end-of-life vehicles from the scrap metal dealers and salvage yards, and ensuring that there is proper management of refrigerants, mercury switches and other problematic substances. Although the incentives offered under this program have improved the management of end-of-life vehicles, a combination of the program ending and higher metal prices could erode the situation again and result in vehicles being shredded without depollution or parts recovery.

In effect, there are two significant problems arising from the current way in which ELVs are managed in Ontario, and more generally in Canada. First, there is the sheer volume of waste from vehicles going to landfills in Ontario every year – 300 million pounds or 136,000 tonnes – which could be significantly reduced through better recovery and recycling of parts and materials. Second, there is the unnecessary contamination of vehicle waste going to landfills because of the lack of requirements for depollution prior to shredding.

6. Laws in Canada and the Provinces

There are almost no laws in place in Canada that require the management of end-of-life vehicles, although there are some regulations that govern vehicle parts and materials, such as tires and ozone-depleting substances.

Regulations in every province, for example, provide for the recovery of ozone-depleting substances. These regulations include chlorofluorocarbons (CFCs), hydrochlorofluorocarbons and hydrofluorocarbons, which are used in air conditioning units in end-of-life vehicles. Generally, the regulations require

[21] Personal Interview with Steve Fletcher, Auto Recyclers of Canada, Nov. 17, 2009.

recovery and recycling of ozone-depleting substances, prohibit venting of these substances and restrict "top ups". However, there is little auditing or enforcement of the regulations as they apply to end-of-life vehicles.[22]

Federally, chlorofluorocarbons are covered by an environmental code of practice, which provides only guidelines for the reduction of emissions and is not legally binding.[23] It says that "it is essential that all refrigerant in the air conditioning system be removed and oil collected according to local regulations before the car is wrecked or scrapped".[24]

In addition to regulations governing ozone-depleting substances, there are provincial regulations in all Canadian provinces to recover scrap tires. The tire recycling programs impose fees on producers and importers that are used to finance the collection and recycling of used tires. Recycling tires is not mandatory under these programs. However, where regulations have been put in place, such as those for scrap tires, they have resulted in relatively high recovery rates. As well, all provinces have established recycling programs for batteries, and several have recycling programs for used oil and used oil filters.[25]

Aside from limited provincial regulations focussed on ozone-depleting substances and selected materials, only one province in Canada, British Columbia, has a law governing the depollution and management of ELVs.

British Columbia's *Vehicle Dismantling and Recycling Industry Environmental Planning Regulation* requires vehicle dismantlers and recyclers to develop environmental management plans by September 2008, or be a member of an association that has developed a plan. Plans cover the depollution of vehicles, and require auto recyclers to address the management of:

- Ozone depleting substances and other halocarbons;
- Oils, brake fluids, solvents, fuels and other hydrocarbons;
- Antifreeze;
- Lead and lead-acid batteries;
- Tires;
- Mercury switches; and,
- Windshield washer fluids.

In addition, plans, which have to be updated every 5 years, must describe how

[22] Automotive Industries Association of Canada, "Shifting into High Gear: The Benefits of Pollution Prevention Practices in the Automotive Aftermarket", February 25, 2004, p.2.
[23] The Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems was developed under Section 8 of the *Canadian Environmental Protection Act*.
[24] Ibid. Section 4.4 Handling of Refrigerant in Automobiles Slated for Wrecking. Accessible at www.ec.gc.ca/ozone/DOCs/SandS/RAC/EN/cop/index.cfm
[25] Automotive Industries Association of Canada, "Shifting into High Gear: The Benefits of Pollution Prevention Practices in the Automotive Aftermarket", February 25, 2004, p.22.

these materials will be stored, treated, recycled or disposed of, and set out the processes for minimizing or eliminating their discharge to the environment. The B.C. program also has provisions for a third party audit of vehicle recyclers. It is not known what impact this regulation has had on jobs.

However, with the exception of B.C., even the recovery of mercury lighting switches is not required by the federal government or by any other province, and their recovery depends largely on the awareness of the auto recovery operator handling the end-of-life vehicle.

A voluntary national program, called Switch Out, has been set up to remove, collect and dispose of mercury switches and mercury-containing anti-lock brake system sensor modules before they go to through the shredding process.[26] The program is supported by the steel industry in order to meet their obligations under the federal *Canadian Environmental Protection Act*. Under this Act, they are required to develop and implement pollution prevention plans for mercury released from end-of-life vehicles. Phase out of mercury from vehicles began in the 1990s, but many older ones still contain mercury switches.

Although auto recyclers who are members of ARC process only 1/3 of the vehicles retired in the province of Ontario every year, they recover 75% of the mercury switches.[27] This recovery rate suggests that many of the vehicles not being handled by ARC members are going to shredders without being depolluted.

[26] Switch Out, "About the National Program". Accessible at www.switchout.ca
[27] Personal Interview with Steve Fletcher, Auto Recyclers of Canada, April 2010.

Summary:

- Almost 65% of end-of-life vehicles in Ontario do not go to auto recycling facilities whose business includes dismantling and that comply with the industry standard for depollution. The disposal of vehicles at salvage yards or scrap metal dealers represents a loss of recyclable parts and materials, a loss of jobs in the dismantling process, and potential environmental degradation.

- When end-of-life vehicles are taken to reputable auto recycling facilities, parts and materials that make up 80 to 85% of the vehicle by weight are potentially recovered and recycled.

- In Ontario alone, approximately 300 million pounds or 136,000 tonnes of auto shredder waste, including many tons of potentially recyclable material, is going into landfills each year.

- With the exception of British Columbia, there are no laws in Canada governing the management of the whole end-of-life vehicle, either federally or in other provinces.

- Where programs or regulations exist for certain materials such as tires, there is a high recovery rate of materials.

Part II: Management of End-of-life vehicles in Other Jurisdictions

7. The Management of End-of-life Vehicles in Other Jurisdictions

In contrast to Canada and the United States, most countries that produce cars or car parts have legislated extended producer responsibility for vehicles. This includes all the countries of the European Union (EU), as well as Korea, China and Japan.

These laws have increased the recovery of vehicles and improved the way in which companies, such as auto recyclers and shredders, handle end-of-life vehicles (ELVs). They have also resulted in reductions in the use of certain hazardous substances in the manufacturing process, improved recycling rates and the percentage of materials recovered from retired vehicles, and encouraged design changes that will facilitate future opportunities for recycling.

8. The European Union End-of-life Vehicles Directive

Adopted in September 2000, the European Union's End-of-life Vehicles Directive has been in place for almost 10 years now.[28] Its objectives are:

- to prevent waste from vehicles by improving product design, and;
- to increase the reuse, and recycling of waste.[29]

To accomplish these objectives, the Directive:

- sets recycling and recovery targets for 2006 and 2015;
- eliminates the use of certain heavy metals in vehicles in order to prevent their release into the environment and the contamination of vehicle waste;
- requires permits for treatment facilities that handle ELVs;
- requires depollution of vehicles; and,
- provides for free take-back for all ELVs.

[28] Directive 2000/53/EC on end-of-life vehicles, or the ELV Directive.
[29] European Union, "Management of end-of-life vehicles: Summary". Accessible at www.europa.eu/legislation_summaries/

The intention of the legislation was to hold producers responsible for their products when they become waste so that they would design vehicles for greater recycling. To do this, the legislation encourages member states with national car industries, such as Germany and France, to adopt legislation requiring manufacturers to limit the use of hazardous substances, and to design new vehicles to make dismantling and recycling of vehicles and their parts and materials easier. [30] The Directive also promotes the greater use of recycled material in vehicles. However, even though the Directive contains language to this effect, the legislation does not specifically require these actions.

9. The Experience of the European Union

The ELV Directive is recognized as being moderately successful in meeting its objectives. Some countries -- Netherlands, Denmark, Sweden and Germany – are regarded as being ahead of other EU countries in meeting the provisions of the ELV Directive, such as legislated targets.

Several major assessments have been done of the ELV Directive. Two assessments have reported on the implementation of the Directive, which is required every 3 years.[31] The first report covers the period 2002 to 2005.[32] The second report covers 2005 to 2008.[33]

The evaluations indicate that all EU member states have incorporated the Directive into national legislation. However, the degree to which they have met the provisions of the Directive varies. For example, all countries have adopted legislation restricting the use of lead, mercury, cadmium or hexavalent chromium in vehicles. Similarly, all countries have introduced measures to ensure that end-of-life vehicles are handled by authorized treatment centres, and have established systems that require certificates of destruction as a condition for deregistering vehicles.[34] Certificates of destruction from one European Union country are accepted in other member countries.

In addition, all countries require vehicle manufacturers throughout Europe to provide dismantling information for each new vehicle put on the market.[35] This

[30] Article 4, ELV Directive.
[31] Article 9 obliges member countries to report to the Commission at 3 year intervals.
[32] Commission of the European Communities, *Report from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions on the Implementation of Directive 2000/53/EC on End-of-Life Vehicles for the Period 2002-2005,* and the Annex to the Report, November 17, 2007.
[33] Commission of the European Communities, *Report from the Commission to the Council, the European Parliament, the European Economic and Social Committee, and the Committee of Regions on the Implementation of Directive 2000/53/EC on end-of-life vehicles for the Period 2005-2008,* November 20, 2009.
[34] Ibid, p.3.
[35] Article 8.3, End-of-life Vehicles Directive.

information must be made available to authorized treatment facilities in order to promote recycling. It is known as the International Dismantling Information System.

An in-depth Annex to the first evaluation report on 2002 to 2005 identifies steps that some countries have taken to prevent waste and promote recycling. [36] In most member states, countries had ***not*** taken steps beyond those required in the Directive.

However, a few countries -- Germany, the Netherlands and Sweden -- reported having limited the use of hazardous substances and promoted reuse, recovery and recycling, including design changes in countries where vehicles are manufactured.

In Germany, for example, even before the introduction of the legislation, some vehicle manufacturers had already made efforts to design cars for easier dismantling and recycling, and the prevention of waste. Volkswagen Golf V reduced the use of PVC by using underbody panelling and optimized wheel house liners instead of underframe protection, and secured the fuel tank by a clamping band to make dismantling easier.[37]

However, the report points out that the vehicle industry's focus is on developing and using post-shredder technologies to recover non-metals.[38] The industry wants to avoid the need to dismantle components manually. This has led to a disinterest in dismantling efforts beyond the requirements of the Directive.

10. Targets in the European Union

A third evaluation in 2007 discusses the legislated targets for the re-use, recycling and recovery of ELVs, and whether these targets should be maintained.[39] It evaluates the effects of the established targets and assesses the impact of different targets on the environment and the European economy.

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[36] Annex to the *Report from the Commission to the Council and the European Parliament on the Implementation of Directive 2000/53/EC on end-of-life vehicles for the Period 2002-2005,* p. 51-53.

[37] A number of product-design measures that would improve recyclability were also identified in the report: setting binding recycling standards and guidelines for designers, including recommendations on the design of components and vehicles and on the use of new and secondary materials; using dismantling analyses to assess the recyclability of a vehicle and its parts in order to improve the design for recyclability and dismantling; and, optimizing recyclability through reduction in the diversity of materials, materials coding for all plastics over 100 grams and all elastomers over 200 grams, joining techniques with a view to repair, and pre-treatment. Ibid. p. 53.

[38] Op. cit. p.52.

[39] Targets are established by Article 7 of the ELV Directive. The assessment is found in *Report from the Commission to the Council and the European Parliament on the Targets contained in Article 7(2)(b) of Directive 2000/53/EC on End-of-Life Vehicle - Impact Assessment.*

Targets are one of the most important and controversial measures in the ELV Directive, and are considered a measure of its success in preventing waste.

The ELV Directive established targets of 80% for reuse and recycling of ELVs, and 85% for reuse and recovery, a second higher target which includes energy recovery, by January 1, 2006. For January 1, 2015, the targets are 85% for reuse and recycling, and 95% for reuse and recovery, as shown in the table below:

European Union Target Dates	Recycling & Reuse	Total Recovery, Recycling & Reuse
2006	80%	85% (includes 5% energy recovery)
2015	85%	95% (includes 10% energy recovery)

Table 3. Targets Set in the European Union's End-of-life Vehicles Directive

Note: The EU's lower targets for recycling and reuse indicate *only* the amount of recycling and reuse that must be achieved. They do not include energy recovery. Energy recovery allows materials recovered from an ELV to be incinerated to generate energy. Energy recovery may be used to meet the higher targets that show total recovery, recycling and reuse. This means, that to meet the 2006 targets, no more than 5% of the vehicle can be used for energy recovery, and, for the 2015 targets, no more than 10%.

The assessment showed that, with the recycling of the metals and other recyclable parts, the 80% recycling targets, which were to be met by January 2006, would be achieved by most of the countries. Indeed, the implementation reports concluded that the 2006 targets were met by most, but not all, member countries.[40] As in Canada, a significant proportion of the recycling is achieved by the recycling of metals from ELVs.

The re-examination of the 2015 targets was mandated as part of the Directive. It concluded that any change -- repealing or reducing these targets -- would reduce the substantial environmental and economic benefits that would be

[40] *Report from the Commission to the Council, the European Parliament, the European Economic and Social Committee, and the Committee of Regions on the Implementation of Directive 2000/53/EC on end-of-life vehicles for the Period 2005-2008*, p. 4.

generated by the targets.[41] Because of this, the Commission did not propose any revision to them.

A technical report on the targets, prepared for the Commission, quantified the environmental benefits that have already been realized as a result of the Directive. They included:

- an increase in the number of vehicles treated in authorized treatment facilities;
- an increase in the operating standards of treatment facilities even where they are not in full compliance with the ELV Directive;
- an increased level of treatment for different materials;
- continuing improvements in environmental quality as the Directive is more fully implemented,
- an increased number of technical feasibility studies into the recycling possibilities for plastics, and,
- specific environmental and health related improvements as a result of:

    - a reduction of tonnes of waste oils and other fluids,
    - energy savings from the regeneration of waste oils,
    - a reduction in disposal of sulphuric acid and lead from batteries as a result of safe recycling,
    - a reduction in the volume of tires and glass disposed of in landfills, and,
    - improved management of liquid gas tanks.[42]

However, to meet the higher targets which require 85% recycling and 95% reuse by 2015, countries would have to make more effort to recycle glass, plastics and other materials. Only a few countries had systems for recycling these materials, and markets were difficult to find.

Plastic was singled out as the most important material to recover if countries were to meet the higher targets.[43] The amount of plastics recycling is currently very low due to a number of factors -- an important one being the different types of plastics that are used.

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[41] Commission of the European Communities, *Report from the Commission to the Council and the European Parliament on the Targets Contained in Article 7(2)(b) of Directive 2000/53/EC on End-of-Life Vehicle*, January 16, 2007. The Commission Staff Working Document, an Impact Assessment, which accompanied the report, found that "policy which promotes innovation is most likely to lead to both significant environmental and economic benefits -- with net benefits to all affected parties". p.5.

[42] GHK/BIOS, *A study to examine the benefits of the End-of-life vehicles Directive and the costs and benefits of a revision of the 2015 targets for recycling, re-use and recovery under the ELV Directive*, May 2006, p.9.

[43] Commission of the European Communities, Commission Staff Working Document, Document accompanying the *Report from the Commission to the Council and the European Parliament on the Targets Contained in Article 7(2)(b) of Directive 2000/53/EC on End-of-Life Vehicle,* Impact Assessment, January 16, 2007, p.11.

The emphasis is on the development of post-shredder technologies as the way to achieve the 2015 targets. This would involve a shift from manual dismantling of materials from vehicles before shredding to the separation of these materials through an industrial process after shredding.

In addition, there are still many challenges as new materials are incorporated into new vehicle designs.

11. The Netherlands

The Netherlands illustrates the way in which the ELV Directive is influencing the management of end-of-life vehicles in Europe.

The Netherlands has one of the highest rates of vehicle recycling in the world. To meet its obligations under the ELV Directive, it set up Auto Recycling Netherlands (ARN), a vehicle recycling association, financed by a waste disposal fee paid by vehicle owners as part of the vehicle registration process. The fee is 45 Euros ($60) per vehicle.[44]

In 2008, just over 468,000 vehicles were deregistered. Of these, 209,427 were deregistered as end-of-life vehicles. The other 259,275 were exported.[45] These used vehicles go to Poland and other newer EU countries where they are sold as used vehicles and eventually retired according to EU laws.[46]

The ELV Directive requires that at least 85% of the weight of ELVs must be recycled, reused or recovered, in accordance with the 2006 targets. In 2008, 85.6% of the total weight of discarded end-of-life vehicles in the Netherlands was recycled -- above the EU's targets.[47] Re-use and recycling amounted to 84.4%, and energy recovery was approximately 1%.

The 2015 target is 95%, of which at least 85% must be met by recycling. To meet the higher targets, ARN has chosen to build a post-shredder technology plant (PST), which will recover various materials from shredder residues.[48]

Although some PSTs are operating on an industrial level, most are still in the

[44] ARN, "Sustainability Report 2008: the figures behind the recycling chain". Accessible at www.arn.nl/7contact/dzhv2008/e38.htm.
[45] ARN, "Sustainability Report 2008: the market". Accessible at www.arn.nl/7contact/dzhv2008/e38.htm.
[46] Policy Department, Economic and Scientific Policy, "End of Life Vehicle Directive (ELV): An Assessment of the Current State of Implementation by Member States", 2006.
[47] ARN, "Sustainability Report 2008: legislation and environmental performance". Accessible at www.arn.nl/7contact/dzhv2008/e38.htm

development stage.[49] PSTs process auto shredder residue after dismantling, depollution and shredding, and are based on either mechanical separation or the generation of feedstocks for electricity. Mechanical plants, like the one chosen by ARN, break down shredder residues into raw granules, fibres and sand. The plastics are separated through different treatment processes from the raw granules and sold for recycling, while the shredder fibres are mainly used as a de-watering agent for sewage sludge, which is then incinerated. The residual sludge, dust and shredder sand fractions are also incinerated. It is estimated that this technology will recycle 74% of the auto shredder residue.

The mechanical separation plant, located near Tiel in the middle of Holland, will initially handle 50,000 to 60,000 tonnes of shredder waste each year.[50] Both Volkswagen and SiCon, the designer of the production line, have been involved with ARN in the design, preparation and construction of the plant, which is expected to be operational in the spring of 2011.[51]

The PST was chosen because ARN believes it improves the chances of meeting the recycling targets, and reduces the cost of recovering materials. ARN estimates, for example, that it currently costs around 20 Euros ($26) to remove 10 kilograms of a material such as polyurethane foam. By using post shredder technology, it will cost around 1 Euro.[52]

In addition to being motivated to meet the targets, current legislation in the Netherlands bans shredder waste from landfills. This ban was temporarily suspended until ARN developed the PST technology which would eliminate the need to send shredder waste to landfill.[53]

The PST will change the role of the car dismantling companies that are affiliated with ARN because materials such as foam, which are removed manually now, will be separated mechanically at the plant. Vehicle dismantlers will still remove liquids -- oil, fuel, brake fluid, windshield washing fluid – as well as batteries, oil filters, LPG tanks and air conditioning systems.[54] They will also dismantle airbags and seat belt fasteners, remove batteries from electric and hybrid cars, and retrieve some other parts.

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[49] GHK/BIOS Study, *A Study to Examine the Costs and Benefits of the ELV Directive – Final Report, Annex 3: Post-Shredder Technologies – Review of the Technologies and Costs*, May 2006.

[50] Beck, Manfred, "ARN plant ushers in post-shredder technologies", Recycling International, November 1, 2007. Accessible at http://en.sicontechnology.com/index.asp?id=46

[51] ARN, "PST in the Spotlight", March 29, 2011. Accessible at http://www.arn.nl/english/ARN/News-press/News-ItemsRecycling International; see also "Recycling achievement in the Netherlands 85.6% of each end-of-life vehicle", July 14, 2009. Accessible at www.recyclingbizz.com

[52] Ibid.

[53] ARN, "Sustainability Report 2008: 2008 recycling". Accessible at www.arn.nl/7contact/dzhv2008/e38.htm

[54] Beck, Manfred, "ARN plant ushers in post-shredder technologies", Recycling International, November 1,2007. Accessible at http://en.sicontechnology.com/index.asp?id=46

However, they will no longer be required to remove prescribed materials such as grills, rubber strips, seat belts, polypropylene and polycarbonate bumpers, hub caps and coconut fibre in the first two years after the plant is in operation.[55] In the third year, they will no longer recover glass and tires, which will also be recovered through post-shredder technology.

ARN has identified customers for many of the materials that will be derived from the PST process.

12. Japan's Automobile Recycling Law

Japan has the world's highest rate of vehicles for its population -- one for every 1.7 people.[56] Driven by a shortage of landfill space, it also has the Law for the Recycling of End-of-life Vehicles, which is known as the Japanese Automobile Recycling Law.[57] It came into effect in January 2005.

The key feature of Japan's law is the requirement for recycling fees. These fees are paid by owners at the time of purchase. For older vehicles, owners pay at the time of regular mandated inspection. The law makes manufacturers and importers responsible for the recycling and proper disposal of three designated materials – fluorocarbons, airbags and automobile shredder residue.

The amount of the recycling fee depends on the type of vehicle and the cost of processing it to remove these materials. Recycling fees, set by an independent body, range from $50 to $200.[58] The more recyclable a vehicle is, the lower the recycling fee. Fees are refunded to automakers or importers after they have ensured the proper disposal of an ELV.

Although the recycling fees were supposed to be an economic incentive that would encourage automakers to design more recyclable vehicles, Professor Kenichi Togawa at Kumamoto University, in his review of this law, found that purchasers are not likely to select a car because of a slightly lower recycling fee.[59] Recycling fees were also intended to lessen the export of approximately 1.5 million cars annually from Japan to other countries.[60]

The law designates certain items to be removed from ELVs before shredding --

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[55] Ibid

[56] Japan For Sustainability, "The Recycling of End-of-Life Vehicles in Japan", JFS Newsletter No. 50, October 2006. Accessible at www.japanfs.org

[57] Steve Fletcher, "Japan Recycles!", Canadian Recycler Magazine, January 18, 2008.

[58] These fees are established by a third party fund management institution, and amount to billions of dollars annually. An electronic manifest system tracks vehicles.

[59] Togawa, Kenichi, Japan's Automotive Recycling System: Evaluation Three Years after Implementation, Chapter 5 in *Promoting 3Rs in Developing Countries: Lessons from the Japanese Experience*, ed. Michikazu Kojima, Chiba, IDE-JETRO, 2008, p.118.

[60] Steve Fletcher, "Japan Recycles!", Canadian Recycler Magazine, January 18, 2008.

batteries, tires, waste oil, waste fluids and fluorescent lights. The law assumes that, in addition to the removal of these items, reusable or recyclable components will be recovered before the vehicle is processed into shredder residue.[61]

The law also includes recycling targets. However, the targets apply only to the shredder residue, rather than to recycling the whole vehicle as it does in the EU.[62] The Japanese recycling rates for auto shredder residue were set at 50% by 2010, and 70% by 2015.

To meet the targets, the law also assumes that the quantity of shredder residue would be reduced by applying advanced post-shredding technologies to the residue, similar to the approach being taken in the EU. The targets may also be met in part by energy recovery, which can qualify as recycling if certain conditions are met.

The Japanese law does not promote better design of vehicles in order to facilitate recycling or minimize toxic substances. However, Japanese vehicle makers, influenced by the EU's ELV Directive, have reduced the amount of lead used in their vehicles, and some have also voluntarily reduced the use of brominated flame retardants and polyvinyl chloride.

Summary:

- Most countries with vehicle or parts manufacturing activities have legislation governing end-of-life vehicles, except for the US and Canada.
- Legislation generally provides for tracking of ELVs through deregistration, and sets targets for recycling. Depollution is mandatory, and many countries list components and materials which must be recovered.
- Legislation has increased the recovery of ELVs, increased the level of recovery for materials in ELVs, and resulted in environmental and health-related improvements.
- The trend in Europe is to use post shredder technology to meet recycling and recovery targets, rather than maintaining more labour-intensive dismantling/disassembly centres.
- Japan has used the economic incentive of recycling fees to encourage the public to buy, and manufacturers to design, vehicles which are more easily recycled.

[61] Ibid. p.117.
[62] Ibid. p.114.

Part III. The Reuse and Recycling Potential for ELVs

13. The Status of ELV Materials in Canada

The ultimate goals for managing end-of-life vehicles should be to maximize the use of resources, to minimize pollution and to preserve and enhance employment. Producers and parts manufacturers have the greatest influence on the process that determines the waste management potential of a vehicle. To achieve these goals in an ideal world, producers would design vehicles in such a way that all parts in an end-of-life vehicle could be dismantled and either reused or recycled. Recycling materials has been shown to create 10 times more jobs and revenue than treating the materials as waste.[63]

The following table illustrates the approximate weight of the materials used in vehicles, and the trend lines showing which ones producers are choosing to increase or decrease. As the table suggests, lighter weight plastic components are replacing metal components in order to improve fuel efficiency in vehicles.

	Kilogram per tonne of ELV		
Material/Fraction	**2002**	**2006**	**2015**
Ferrous Metal	680	680	650
Non Ferrous Metal	80	80	90
Plastics and Process Polymers	100	100	120
Tires	30	30	30
Glass	30	30	30
Batteries	13	13	13
Fluids	17	17	17
Textiles	10	10	10
Rubber	20	20	20
Other	20	20	20
Total	1000	1000	1000

Table 4. Composition of a Typical ELV Over Time[64]

Currently, the bulk of materials in end-of-life vehicles have the potential to be

[63] Canadian Association of Recycling Industries, "The Recycling Industry". Accessible at www.cari-acir.org/en/industry.html

[64] GHK/Bio Study, "A study to examine the benefits of the End-of-life vehicles Directive and the costs and benefits of a revision of the 2015 targets for recycling, re-use and recovery under the ELV Directive: Final Report to DG Environment", May 2006., p.72.

recovered and recycled. However, in Canada many materials that could be recycled are not.

In looking at the various components of an end-of-life vehicle, it is evident that improvements in the recovery of materials could be made in the short term through changes in government policy or regulations, and, in the longer term, through improvements in vehicle design. The following section looks at the potential for the recycling of the major materials used in vehicles.

Ferrous and Non-Ferrous Metals - Approximately 76% of the weight of an average car is metal, primarily steel. Although the proportion of metal to plastics is decreasing, there is a very high recovery rate for metal from vehicles in all countries – Canada, the United States and countries of the European Union. In Canada, 42% of all new steel comes from recycled metal. It is estimated that this re-use of metals saves up to 74% in energy and 40% in water consumption.[65]

Plastics - The next largest component of vehicles by weight is plastic, which accounts for about 10% of the vehicle's weight. Currently, the amount of plastics being recycled is very low. Although the proportion of plastic being used in vehicles has increased, the proportion being recycled has not.[66]

One reason for this is the variety of different polymers being used, which include polypropylene (PP), polyethylene (PE), polyurethane (PU) and polyvinyl chloride (PVC).[67] Polypropylene accounts for the majority of car plastics (about 40%), and is used in bumpers, wheel arch liners and dashboards. Like polyethylene and polyurethane, which is common in seat foam, it is easily recycled. Markets for all of these polymers already exist. PVC, however, accounts for about 12% of the plastic used in vehicles, and is very difficult to recycle. No systems are in place for recycling PVC, and disposing of PVC by incineration releases dioxins.

One of the ways in which plastic recycling could be increased is through the identification of the different plastic polymers used in vehicle manufacturing.[68] Marking components during production would make it possible for auto recyclers to remove and sort plastics in retired vehicles. The EU's ELV Directive requires that member countries ensure that producers use material coding standards that allow the identification of various materials during dismantling.[69]

Tires - Tire recycling programs have now been set up in all provinces. Tires represent about 3% of the weight of a vehicle. They are generally financed by an environmental fee charged on the purchase of new tires. Used tires are burned

[65] Green Vehicle Disposal, "What is an End-of-life Vehicle?". Accessible at www.1877endoflifevehiclescom/eol.cfm
[66] Green Vehicle Disposal, "Recyclable materials". Accessible at www.1877endoflifevehiclescom/eol.cfm
[67] *Ibid.*
[68] *Ibid*.
[69] European Union, "Management of end-of-life vehicles: Summary". Accessible at www.europa.eu/legislation_summaries/

to produce fuel, or recycled into a variety of products, including automotive products. Fine mesh crumb or ground rubber can be used as protective liners for truck boxes or as ingredients in new tires.[70] An EU landfill ban on tires increased the percentage of tires being recovered in European countries from 60% to over 95%.[71]

Glass - Used windshield glass, which is 3% of the vehicle weight, has been a very low priority for recycling. As a result, an estimated 18 to 20 million kilograms per year of used glass is disposed of in landfill sites in Canada.[72]

There are two types of windshield glass – toughened and laminated.[73] While it is easy to remove toughened glass when it is shattered, laminated glass does not shatter and needs to be removed manually.[74] Laminated glass is two layers of glass with a strong plastic membrane between the panes. It can only be recycled if the plastic film is separated from the windshield. It can be turned into construction aggregate, Glasphalt or secondary markets like floor tile if the glass can be separated from the plastic film. However, these processes are expensive and not common.[75]

In addition to the challenges of removing and recycling laminated glass, windshield glass is not generally recycled because its value is relatively low, and there are no financial incentives. If glass is recovered, 1.2 tonnes of raw materials are saved for every tonne of crushed glass used in manufacturing.

Batteries – Recycling programs for lead-acid batteries are in place across Canada, and it is estimated that more than 90% are recycled. Industry results from US data show that about 97% of spent battery lead was recycled from 1997 to 2001.[76] Although batteries comprise only about 1% of a vehicle by weight, it is important that they are recovered and recycled because lead is hazardous.

Fluids – All provinces have some form of stewardship program to recover and recycle used motor oil and other lubricants, but only Alberta, Manitoba and Saskatchewan measure progress and report results on a regular basis.[77] A 2004

[70] Canadian Association of Tire Recycling Agencies, "Scrap Tire Recycling in Canada". Accessible at: www.catraonline.ca/eng/recyclage-pneus.html
[71] Recycling International, "Europe speeds to tyre recycling record", November 20, 2009. Accessible at www.recyclingbizz.com
[72] Automotive Industries Association of Canada, "Shifting into High Gear: The Benefits of Pollution Prevention Practices in the Automotive Aftermarket", February 25, 2004, p.26.
[73] Green Vehicle Disposal, "Recyclable Materials". Accessible at www1877endoflifevehicles.com/rematerials.cfm
[74] GHK/BIO Study, "A study to examine the benefits of the End-of-life vehicles Directive and the costs and benefits of a revision of the 2015 targets for recycling, re-use and recovery under the ELV Directive: Annex 2", May 2006, p.17.
[75] *Ibid.* p.25.
[76] Automotive Industries Association of Canada, "Shifting into High Gear: The Benefits of Pollution Prevention Practices in the Automotive Aftermarket", February 25, 2004, p.2.
[77] *Ibid.* p.2.

estimate by the Automotive Industries Association (AIA) calculated that 93 million litres of oil were being recycled by the three provinces that require reporting, but that a possible 381 million litres being used in the other provinces were not.[78] The AIA concluded that recycling used oil could be improved. It is possible that there has been some improvement since 2004 with the introduction of a program in Quebec. However, Ontario still does not have a formal program.[79] The other liquids – like windshield washer fluid and antifreeze – may or may not be recovered, as discussed earlier.

Textiles – Textiles refer to carpets and other upholstery in ELVs. They make up about 1% of the vehicle by weight, and are usually disposed of as auto shredder residue.

Rubber – Similarly, rubber, which comprises 2% of the vehicle by weight, is not recovered, and goes to landfill as part of the auto shredder residue.

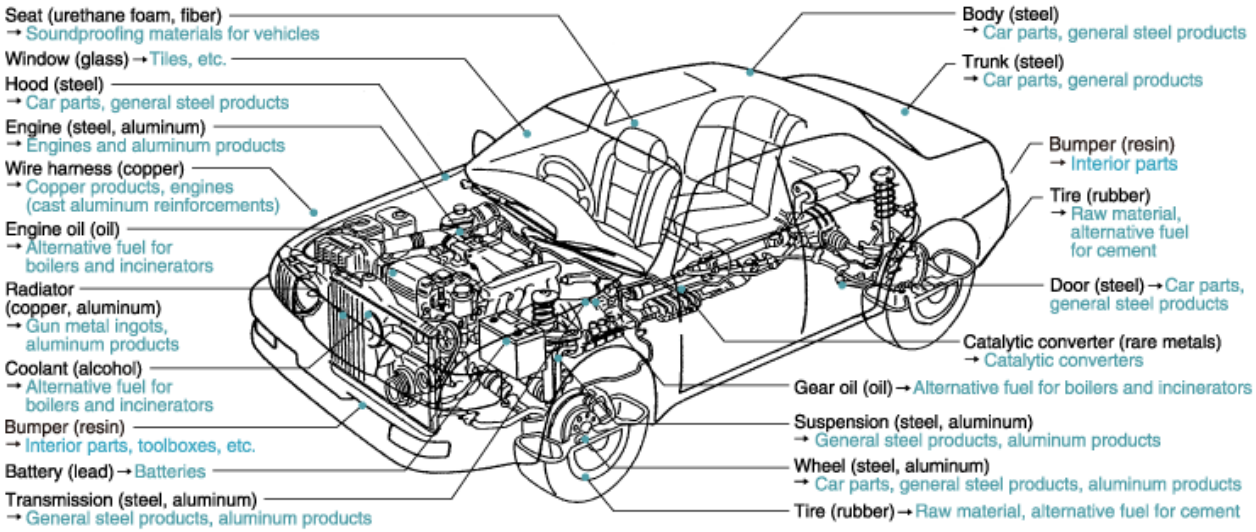

Figure 1. Examples of Parts and Materials That Can Be Recycled from End-of-life Vehicles (Toyota)

14. The Elimination of Hazardous Chemicals

Beyond the immediate potential for recycling vehicles on the market today, the goal of maximizing resources and attaining higher recycling rates can only be

[78] *Ibid.* p.23.
[79] Environment Canada, "Extended Producer Responsibility and Stewardship: Oil and Oil-Related Products". Accessible at www.ec.gc.ca/epr/default.asp?lang=En&n=66F456E1-1

achieved in the design stage. An important aspect of designing for less environmental impact and greater recycling potential is minimizing the use of toxic chemicals in vehicle manufacturing. The use of less toxic chemicals would also reduce the risks to the health of workers in vehicle and parts manufacturing plants, workers in the auto recycling business, and people in their vehicles. For example, the elimination of polyvinyl chloride (PVC) in vehicle components would reduce workers' exposures to a chemical with possible carcinogenic effects.[80]

As mentioned before, the EU's ELV Directive promotes the reduction and elimination of hazardous chemicals.[81] It encourages vehicle manufacturers to limit the use of hazardous substances in vehicles, particularly in the design stage, so that recycling is easier and hazardous substances are not released into the environment. The Directive also specifically targets the reduction or elimination of lead, mercury, cadmium and hexavalent chromium. Although there are some exemptions, countries were responsible for ensuring that vehicles on the market after July 1, 2003 did not contain certain materials or parts containing these chemicals.

Some vehicle manufacturers, such as Toyota, have made a voluntary commitment to phase out the EU-targeted chemicals from cars and trucks made in North America as well as from vehicles made for the Japanese and European markets.[82] Levels in North American vehicles now meet the EU standards.

In addition to heavy metals, environmental organizations have raised concerns about the use of certain plastics, brominated flame retardants and volatile organic compounds in vehicles.[83] Many plastics, such as PVC used in dashboards and exterior trim, release toxic chemicals during production, use and disposal, as well as being difficult to recycle.[84] In addition, PVC releases phthalates, another chemical of concern. At least one manufacturer, Honda, is trying to eliminate PVC from its North American vehicles.

15. Reducing, Reusing and Recycling

The automobile industry, which is a significant sector of the Ontario economy, is centred on assembling vehicles and supplying parts. Although Canada consumes approximately 10% of the North American vehicle market, it produces

[80] International Agency for Research on Cancer, Vinyl Chloride, Polyvinyl Chloride and Vinyl Chloride, Vinyl Acetate Copolymers, 1979. Accessible at www.inchem.org/documents/iarc/vol19/vinylchloride&polymers.html
[81] Article 4, ELV Directive.
[82] Toyota, "Challenge, Commitment, Progress: 2009 North America Environmental Report", Dec. 2009.
[83] Ecology Centre, "2006 Automotive Plastics Report Card", November 2006; "Toxic at Any Speed: Chemicals in cars and the need for safe alternatives", January 2006.
[84] Ecology Centre, "U.S Automakers receive near failing grades on the use of environmentally safe plastics in cars", February 23, 2005.

about 15 to 20% of the vehicles on sale in North America.[85] In addition, about 60 to 70% of a vehicle is made by vehicle parts manufacturers, such as Magna International, which is the largest North American automotive supplier and is headquartered in Ontario.[86]

The presence of parts manufacturing and research centres in the province gives the Ontario government an opportunity to initiate research and development into the recyclability of vehicles. Ontario has some research and development capacity. One facility, the Auto Research and Development Centre (ARDC) operated by Chrysler, is located in Windsor, and, among other projects, has conducted research and testing on the recyclability of ELVs.[87] In addition, some research in Ontario is being done at universities on the potential use of bio-based materials in vehicles.

The Ontario government can play a role both in encouraging producers and parts manufacturers to improve the recyclability of vehicles through their research and design work, and in ensuring that ELVs are well managed.

More than 40,000 people in Canada and the U.S. work in the auto recycling business, and gross annual revenues were estimated at $8.2 billion in 1997.[88] If policies or regulations were in place for the proper management of ELVs, Ontario could achieve a much higher level of recycling and create more jobs. A regulated framework for auto recycling could potentially increase employment by at least another 50% over current levels since auto recyclers in Ontario handle less than half of the vehicles being retired.

Not only could Ontario ensure that all ELVs are properly managed, thereby stimulating greater recycling efforts, but the provincial government can also help find markets for the materials found in ELVs, Although markets exist for some materials, there is a need to develop them for those that are less easily recycled, such as windshield glass.

The Ontario government's Stewardship Ontario program has been successful in developing markets and increasing capacity for other materials recovered through provincial recycling programs.[89] Similar work could be done to develop markets for materials recovered from ELVs and to promote new manufacturing facilities based on these materials.

Experience in the Netherlands has shown that ELV recycling is a profitable and

[85] Dr. Peter Frise, CEO Auto 21"Ontario's Automotive Future – Getting from Here to There", Slide Presentation to the Ontario Centre for Engineering and Public Policy, Toronto, Ontario, Nov. 24, 2009.
[86] Magna International, "North America" Accessible at www.magna.com
[87] Personal Communication with Dr. Peter Frise, CEO, Auto 21 on May 7, 2010.
[88] Automotive Industries Association of Canada, "Shifting into High Gear: The Benefits of Pollution Prevention Practices in the Automotive Aftermarket", February 25, 2004.
[89] Stewardship Ontario, "Plastics Market Development". Accessible at www.stewardshipontario.ca/bluebox/market/plastics.htm

sustainable business.[90] According to their statistics, efficient operators of auto recycling businesses achieve a profit of between 67 and 127 Euros (between $87 and $165) for materials recovered from each ELV. This does not include reusable parts, which can be sold for more revenue. The following charts show the costs and the revenues from auto recycling in the Netherlands (in Euros):

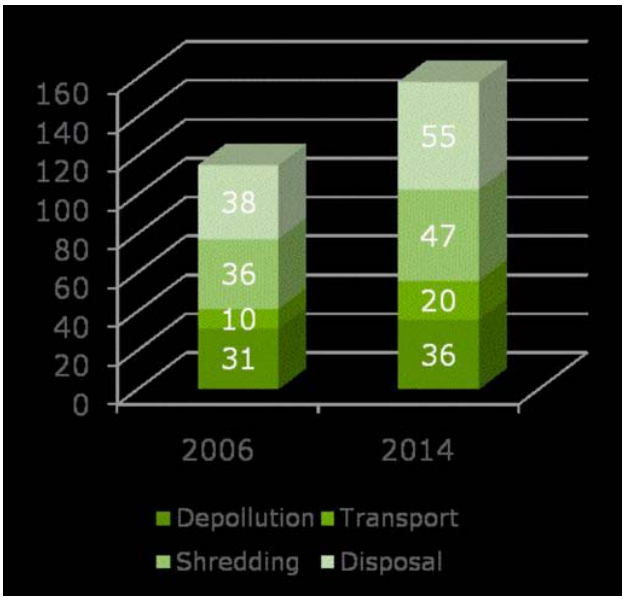

Figure 2. Costs

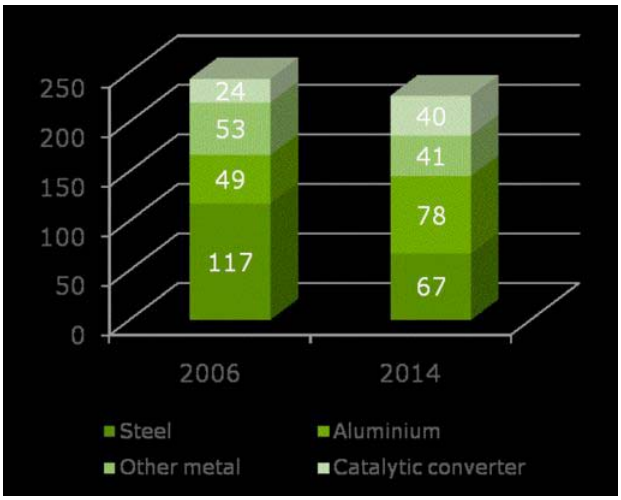

Figure 3. Revenues

[90] Kasper Zom, ARN, "Car Recycling in Europe: optimizing your Vehicle Mining operation", Presentation to Ontario Auto Recyclers Association Conference, Toronto, Ontario, March 27, 2010.

Although the European Union has adopted legislation and policies which promote post-shredder recovery of materials, there has been very little analysis of the costs and benefits of manual dismantling compared to post shredder technologies, or the potential for applying alternative recovery methodologies to increase materials recovery for "post-dismantling/pre-shredder" recycling.

Post shredder technologies may reduce the cost of recovering materials. However, they also present challenges with commingled, and possibly contaminated, shredder fluff, and they are likely to result in fewer jobs in the auto recycling sector. Without investing in new technology, Ontario can achieve high rates of recycling by building upon the existing infrastructure for vehicle recycling.

Summary:

- Vehicle manufacturers have the most control over the potential recyclability of components and materials through vehicle design. However, parts make up 60 to 70% of a vehicle, and Ontario could influence the design of parts for greater recyclability.

- Although metal, which represents the largest percentage of a vehicle, is usually recycled in Canada, other materials, such as plastics which make up an increasingly high percentage of the vehicle's weight, are relatively poorly recycled. Similarly, there is little recycling of windshield glass.

- Given that plastics and glass make up approximately 13% of the car by weight, significant improvements in the recovery and recycling of end-of-life vehicles could be made by facilitating the methods of removal and recovery, by developing markets for these materials and by improving the identification of materials used in manufacturing, particularly plastics.

- Toxic chemicals, even those which are banned in the EU, may still be present in North American vehicles. Only voluntary actions taken by individual manufacturers are reducing toxic chemicals used in vehicle manufacturing.

- The Ontario government could encourage research and development in the design of vehicles and their parts and materials through existing research centres.

- Ontario could create a regulatory framework for ensuring that all ELVs in the province are properly managed and depolluted, thereby reducing waste and creating employment.

Part IV: Law and Policy Questions

16. Discussion and Recommendations

Canada is moving towards adopting extended producer responsibility at the national level. As well, Ontario is currently reviewing its *Waste Diversion Act* and has proposed addressing end-of-life vehicles within 5 years. The issue of how extended producer responsibility is implemented in Canada is important for both labour and environment groups.

At the present time, Canada is in roughly the same position as the European Union countries prior to the ELV Directive coming into force. That is, except for British Columbia, market forces determine the level of recovery of vehicles and parts in all provinces and territories, and there are no regulations that govern the recovery of whole vehicles or the majority of their parts. Because there is considerable value in the metal that can be recovered from ELVs and because there are opportunities to recycle a number of parts, a network of auto recyclers is in place across the country, and they recycle a significant proportion of parts and materials from discarded vehicles.

However, there are few rules or incentives to recover other less valuable materials from end-of-life vehicles, and a significant percentage of waste from vehicles goes to landfill after shredding. Furthermore, because there is only one province in Canada that requires treatment of end-of-life vehicles, many retired vehicles are being recycled for their metal content without recovery of their parts or without being depolluted. As a result, the volume of shredded auto waste going to landfills is considerable, and an unknown amount of it may be seriously contaminated.

The goal of putting in place laws or policies relevant to end-of-life vehicles is to eliminate waste and hazardous materials while creating jobs and economic activity. The following policies are proposed with the intention of influencing government in a direction that will move us to a more sustainable auto industry:

1. Regulate facilities that handle ELVs in order to ensure the proper collection, depollution and dismantling of all end-of-life vehicles.

The first issue that needs to be addressed in Canada, in general, and Ontario, in particular, is to ensure that all retired vehicles are taken to reputable, licensed auto recyclers.

The environmental benefits of regulating the auto recycling industry would be ensuring depollution of vehicles prior to shredding, increasing the recycling of

auto parts and materials, and diverting materials from landfill. There would also be a reduction in the need for virgin resources, which would reduce air and water pollution.

In addition, there would be significant economic benefits. Auto recycling facilities employ over 40,000 people in Canada and the US with gross annual revenues of $8.2 billion in 1997.[91] Regulation would lead not only to better management of end-of-life vehicles but to a possible 50% increase in Ontario in jobs in the auto recycling industry.

2. Establish a set of minimum technical standards as part of the permitting process, including mandatory depollution.

Many hazardous materials in cars are going to landfill with the shredder residue. In Canada, except for British Columbia, not even the removal of mercury switches from end-of-life vehicles is regulated, although a voluntary national program encourages their collection. Retired vehicles represent a major source of lower cost scrap metal for steel manufacturing. Recovering mercury and other hazardous components from vehicles assists the steel industry to minimize contamination of steel during the recycling of ELVs. Rather than rely on voluntary programs and incentives, removal of certain hazardous parts and fluids should be made mandatory at the dismantling stage before any shredding of vehicles is done. This would boost the recovery of metals, such as steel, and maintain or increase the number of jobs within the steel industry. The National Code developed for the Retired Your Ride Program by ARC could serve as a basis for the development of technical standards.

3. Require decertification and certificates of destruction for end-of-life vehicles.

In Canada, vehicle registration is required, but vehicle licenses differ from province to province. Regulation that required decertification would allow government and industry to track ELVs, and to develop policies based on an understanding of their use and eventual fate. European experience has shown that decertification leads to a more regulated auto recycling industry, which manages retired vehicles in a responsible manner.

4. Require all vehicles that are sold in Canada to be dismantled or disassembled in Canada.

Many countries, which have put in place regulations to track and manage retired vehicles, have found that a high percentage of used vehicles are exported. This is a problem for both the Netherlands and Japan where processes for properly handling ELVs have been established. It is likely that the exported vehicles will

[91] Automotive Industries Association of Canada, "Shifting into High Gear: The Benefits of Pollution Prevention Practices in the Automotive Aftermarket", February 25, 2004.

be retired in countries with less stringent requirements and inadequate processes. Therefore, in order to ensure that the vehicles used in Ontario and in Canada are properly managed, the federal or provincial governments should require vehicles sold here to be depolluted, dismantled and disassembled here.

5. Optimize dismantling prior to shredding with the goal of increasing materials recovery, reducing shredder residue volumes, and reducing contaminants.

Dismantling is a very labour intensive process. It involves the recovery of vehicle parts and materials for direct reuse, for remanufacturing and reuse, and for recycling. However, it is not perceived as a preferred alternative to recovering materials after shredding because it is a manual process. It is regarded as cost prohibitive in North America because of labour costs, but **very little analysis has been done on the benefits and impacts of dismantling in comparison with other end-of-life vehicle processes such as post shredder technologies**. Post shredder technologies are currently being promoted in the European Union as a way to achieve the 2015 recycling targets.

In North America, it is estimated that the percentage of recovery by weight of materials and parts from end-of-life vehicles may already be as high as 80 to 85% at facilities where materials are recovered. This strength could be improved by developing stronger markets and new recycling opportunities for materials from end-of-life vehicles. This would create more jobs and would achieve the same results as post-shredding technologies.

Another related issue is the reuse of vehicle parts. In some cases, owners do not view used vehicle parts as acceptable substitutes for new parts. Incentives and education are needed to improve this situation.

6. Set recycling targets for parts and materials.

Recycling targets have been adopted by all countries regulating end-of-life vehicles, and they have been generally successful in increasing recycling rates of ELV parts and materials.

7. Require manufacturers and importers of cars to label parts and to provide manuals for disassembly to auto recyclers.

This is being done in the EU as part of the ELV Directive. It would directly assist auto recyclers in North America in the separation of materials before vehicles are shredded, and increase recycling rates, particularly with respect to plastics.

8. Enact regulations to reduce and eliminate toxic chemicals from use in vehicles and their components.

Following the lead of the European Union, Canada should put in place regulations that eliminate the use of the same toxic materials that have been targeted in the ELV Directive -- lead, mercury, cadmium, and hexavalent chromium.

In addition, some car manufacturers are moving to phase out PVC plastic, flame retardants, phthalates and other toxic chemicals from their vehicles. The government should encourage the phase out of toxic materials in vehicles through regulation. This would lead to improvements in conditions in manufacturing plants, by reducing the exposure of workers to potentially toxic chemicals. It would also make recycling easier.

9. Require deposits on new vehicles, and return these deposits to owners when the vehicles are disposed of at licensed facilities.

As part of extended producer responsibility, ecofees can help ensure that vehicles will be returned to auto recycling facilities at the end of their usefulness. The cash incentives that were offered by the Retire Your Ride program directed vehicles to facilities where they were more efficiently and properly managed. However, with the end of this program, it is unclear whether ELVs will go back to the less managed environment of the previous years.

10. Ban recyclable materials such as tires, windshield glass and polypropylene plastic from landfills, and/or impose high taxes on landfilled shredder residue.

The Netherlands, and Germany as well, have used disposal bans to encourage recycling and reuse of materials. An EU landfill ban on tires resulted in up to 60% of the 3.3 million tonnes of end-of-life tires being collected and treated in 2008, with an energy recovery rate of 35%.[92]

11. Require the use of a certain percentage of recyclable materials in new cars as part of a shift to emphasizing design for the environment.

Some vehicle manufacturers are using recycled materials in the manufacturing of new cars. Encouraging greater use of recyclable materials would help create markets for materials for which there are limited recycling opportunities at present.

[92] Recycling International, "Europe speeds to tyre recycling record", Nov. 20, 2009. Accessible at www.recyclingbizz.com.