



# Automobile End-of-Life Management Issues

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## Introduction:

Recycling of obsolete automobiles, that is automobiles that have reached the end of their useful life, through the dismantling, scrap processing, and materials recovery infrastructure has been a viable industry in the U.S. for many years. Prior to 1960, and the development of the hammermill, the U.S. scrap processing and materials recovery industry employed processes where obsolete vehicles were stripped of valuable parts, and the remaining hulk was compacted using a baler. The composition of baled automobiles was widely variable and the origin of the material unknown.

The introduction of the hammermill provided a technology for removing paint, coatings, plastics, woods and other contaminants from the processed steel scrap. This technology, combined with the development of various separation techniques, improved the quality of the scrap products and improved scrap processing industry economics.

The number of vehicles scrapped in the U.S. is estimated at 8 million vehicles per year, using vehicle de-registration data. These vehicles are handled by an estimated 12,000 dismantlers and 200 scrap processors. The complexity of the automobile design, the multitude of materials used, and the significant time delay between vehicle design and end-of-life disposal make the automobile an interesting case study for evaluating end-of-life options.

The newly manufactured vehicle is composed of thousands of components, sub-assemblies, and assemblies consisting of many different materials and alloys. Each material and application is selected with a very distinct purpose. At the end-of-life, the vehicle contains only a few components, sub-assemblies or assemblies that have functional value, or that can be remanufactured to have functional value. The remainder of the obsolete vehicle is classified as three major product streams: Ferrous metals, non-ferrous metals, and non-metallic residue.

Currently, the success of the U.S. dismantling and scrap processing industries, results in the obsolete automobile hulk having a net positive value of between \$50 and \$100 per ton. Continued viability of the scrap processing industry hinges on maintaining the industry economics so that the

value of the recovered materials (ferrous and non-ferrous metal scrap) continues to outweigh the processing and shredder residue disposal costs.

Over the past twenty years, ferrous content in automobiles has decreased both absolutely and also proportionally with respect to overall vehicle weight. This decreased ferrous content combined with the increased use of non-metallic materials (most significantly, plastics) has evoked concern that the viability of the existing scrap processing industry is threatened.

## Objectives of Research:

This work investigates the engineering and economic implications of the changing mass and composition of automobiles on end-of-life materials recovery and waste disposal. Modeling the mass and energy flows is used to evaluate the impacts of alternative proposed environmental regulations like target recycling rates and recycled content.

## Methodology:

Empirical studies of current end-of-life processes are the basis for constructing a spreadsheet model of mass, energy, and dollar flows. Proposed regulations are described in terms of adding or removing unit operations from the end-of-life flow sheet. Consequences are evaluated in terms of changes in the amount and composition of residuals impacting the environment, changes in the size and organization of the scrap processing firms, and changes in the total costs.

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