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Comparative analysis of scrap car recycling management policies

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Abstract

With the rapid development of community economic and the constant improvement of the level of living in our country, the number of the private car owned by local residents is increasing rapidly, and scrap cars also bring serious problem in treatment and disposal of Solid Waste. In this paper GREET (The Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation Model) was used to calculate energy use and GHG emissions in different ways of car recycling. Based on the result, the paper proposes some advice to optimize the management of recycling of scrap car.

Keywords:Scrap car; GHG model; Policy comparative analysis

1. Background

Accompanied by a transfer of the global automotive industry, China has become the biggest automobile production and sales country, vehicles and cars with an annual output of more than 18 million and 9 million [1]. In accordance with the private car about 15 year service life, the car scrappage also will increase rapidly in the next 10-15 years [2].

Recycling and reusing of scrapped cars in China are still in its infancy stage. Based on the existing regulations, the “car five assemblies” cannot be directly recycled [3]. Therefore, scrap car recycling primarily is through the sale of scrap steel to achieve. In addition, car parts’ remanufacturing is still in the pilot phase, and the relevant new regulations have not yet been implemented [4].

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Chinese scrap auto recycling rate is only around 40% at present [5]. Thinking in terms of private property, private car's scraping is more difficult to management, because owners of private cars need a higher level of financial compensation.

2. Environmental impact of Scarp Car

2.1. Solid waste

Vehicle manufacturing is a systematic project, and includes tens of thousands of spare parts and related materials. Private cars are made up of various materials including iron and steel, non-ferrous metals, plastics, glass, rubber, and so on. It will generate large amounts of solid waste pollution and oil contamination.

Steel is the major component materials of vehicles, accounting for the total vehicle weight of more than 70% [5]. After scrapping process, scrap steel will be sold in the market for remanufacturing. Non-ferrous metals such as aluminium, copper and magnesium were separately collected after the shredding, but alloy forms making the recovery more difficult [6].

Rubber, glass and other components are often randomly stacked or incinerated, which will use the land and pollute the atmosphere [7].

2.2. Energy use and emission

From the viewpoint of the LCA (life cycle analysis), the extraction, transportation, metallurgy and manufacturing, all these processes of materials, will use the energy and produce various types of gas emission.

Energy consumption includes coal, natural gas, oil and other varieties. Gas emissions mainly includes: VOC, CO, NO_X, PM10, PM2.5, SO_X, CH4, N_2O, CO_2 etc [8].

3. The life-cycle environmental impact of material

The life cycle energy consumption and emissions to the Materials, related the technology and management, were also directly affected by the different recycling policy.

3.1. Two policy scenario

According to the existing regulations and policies pilot, set two kinds of situations. One scenario is the material dismantling and recycling, in steel reusing as an example; the other is the recycling of car components, with the engine remanufacturing as an example.

3.2. GREET model

Greenhouse gases, Regulated Emissions, and Energy use in Transportation (GREET) model was developed by the Argonne National Laboratory. The vehicle-cycle model (GREET 2.7) evaluates the energy and emission effects associated with vehicle material recovery and production, vehicle component fabrication, vehicle assembly, and vehicle disposal/recycling. The model structure is shown in Figure 1.

GREET 2.7 calculates the vehicle-cycle emissions of five criteria pollutants: volatile organic compounds (VOC_S), carbon monoxide (CO), nitrogen oxides (NO_X), sulfur oxides (SO_X), and particulate matter with diameters of 10 micrometers or less (PM10). The model also calculates the vehicle-cycle