

Steel

Steel is a versatile commodity that plays a major part in everyday life—it is used in applications ranging from food cans and household containers to automobiles and office buildings. Steel makes up the largest category of metals in the municipal solid waste (MSW) stream. For many years, steel has been a commonly recycled material in North America and throughout the world. Efficiently managing and recycling used steel products is important to maximize the utility of this commodity.



Just the Facts

- More than 1,000 facilities in the United States make and process steel, and most are located in the Great Lakes region and the South.
- In 2006, the United States generated nearly 3 million tons of steel as containers and packaging in the MSW stream, as well as 11.5 million tons of ferrous metals, which include iron and steel, as durable goods.
- The total amount of ferrous material generated in 2006 - 14.2 million tons - represented 5.7 percent of total MSW generation in 2006.
- The amount of ferrous metals (iron and steel) generation in MSW has declined from 11.7 percent in 1960 to 5.7 percent in 2006.
- Other sources of steel in the MSW stream are containers and packaging, such as food packaging and aerosol cans.
- Large quantities of steel and other ferrous metals are found in construction materials and transportation products, such as automobiles, locomotives, and ships, but these are not included in calculations of MSW. These non-MSW products are, however, highly recycled. In 2006, the steel industry recovered and recycled more than 14 million tons of shredded steel scrap from automobiles—a recycling rate of 95 percent, according to the Steel Recycling Institute (SRI).

How Steel is Made

Steel is an alloy of iron, produced by heating coke, iron ore, and limestone in a blast furnace. It is produced in one of two ways: the basic oxygen furnace (BOF) process and the electric arc furnace (EAF) process.

The BOF process uses 25 to 35 percent recovered steel to make new steel. It combines molten iron from blast furnaces with an injection of very pure oxygen, which causes a chemical reaction. Products such as automotive fenders, refrigerator encasements, soup cans, pails, and industrial drums are made with this type of steel. BOF steel is ideal for these applications because of its "drawability," or ability to be flattened into sheets.

The EAF process uses virtually 100 percent recovered steel to make new steel. Scrap steel is melted and refined by passing an electric current from electrodes through the material. Products such as structural beams, steel plates, and reinforcement bars are made with this type of steel because it is so strong.

How Steel is Recycled

Steel cans from MSW and other steel recyclables are usually collected from the curbside, drop-off sites, or multi-material buyback centers. The steel is then hauled to a material recovery facility, where workers separate it from other recyclables and crush it in to large bales. The bales are shipped to steel mills or foundries, where they are combined with other steel scrap and melted in a furnace to make new steel.

Benefits of Steel Recycling

The steel industry in North America has been recycling steel scrap for more than 150 years. The steel industry needs scrap to produce new steel, which ensures that all steel products contain anywhere from 25 percent up to 100 percent recycled content. It also is cheaper to recycle steel than it is to mine virgin ore to manufacture new steel. New ore is still mined in order to supplement production of steel and steel products.

Recovering steel not only saves money, but also dramatically reduces energy consumption, compared to making steel from virgin materials. In turn, this reduces the amount of greenhouse gases released in to the air during processing and manufacturing steel from virgin ore.

Markets for Recovered Steel

Because using recovered steel to manufacture new steel products saves money, manufacturers have an incentive to promote steel recovery, thus ensuring high recycling rates. Steel products, including the following, can contain between 25 and 100 percent recycled content:

- Steel cans and containers comprise more than 90 percent of the food can market in the United States, according to the American Iron and Steel Institute (AISI). They contain up to 30 percent recycled steel.
- By weight, typical large appliances (e.g., washing machines, refrigerators), consist of about 65 percent steel. The steel used in appliances, like all steel, is made with a minimum of 25 percent recycled steel. As of 2000, a total of 18 states had enacted landfill bans for appliances, meaning that they must be recycled, according to SRI.
- Steel and iron components make up nearly 65 percent of the average automotive vehicle, according to SRI. The steel used in car bodies is made with a minimum of 25 percent recycled steel, and many internal automotive parts, such as engine blocks, are made using even higher percentages of recycled steel. Automotive vehicle recycling is calculated separately from the MSW recycling rate.
- Because of its strength and durability, steel has long been the principal building material for commercial construction. Additionally, steel-framed residential homes are increasing in popularity, and by 2002, an estimated 25 percent of all new homes built in the United States will be totally or partially framed in recycled steel, according to SRI. Other construction products, such as roofs and bridges, also are made from recycled steel. Building and construction material recycling is generally calculated separately from the MSW recycling rate.

Source Reduction/Lightweighting

Source reduction is the process of reducing the amount or toxicity of waste generated. The steel industry has successfully been able to reduce the amount of material needed to make the same products. According to data from AISI, over the past 25 years, the thickness of steel containers has been reduced by 30 percent, from 0.20 millimeters (mm) to 0.14 mm. Technological developments in gauge control are further reducing thicknesses to 0.12 mm. Thickness will continue to be reduced through more advanced technology and higher-quality steel. Steel for automobiles has also become more lightweight, especially given recent demand for lighter, more fuel-efficient vehicles.

Source: United States Environmental Protection Agency