Steel Recycling Institute

2003
The Inherent Recycled Content of Today's Steel

This paper provides an overview of the methods used to produce steel in North America today, and describes steel's inherent recycled content. Contemporary technologies produce steel in two ways, both of which require old steel to make new.

The basic oxygen furnace (BOF) process uses 25 to 35 percent old steel to make new. It produces products--such as automotive fenders, encasements of refrigerators, and packaging like soup cans, five-gallon pails, and 55-gallon drums--whose major required characteristic is drawability.

The electric arc furnace (EAF) process uses virtually 100 percent old steel to make new. It produces products--such as structural beams, steel plates, and reinforcement bars--whose major required characteristic is strength.

Many are surprised to learn that steel is the world's, as well as North America's, most recycled material, and in the United States alone, almost 69 million tons of steel were recycled or exported for recycling in 2003. This is done for economic as well as environmental reasons. It is always cheaper to recycle steel than to mine virgin ore and move it through the process of making new steel. However, it should also be clearly understood that many steel applications are durables, and even though two out of every three pounds of new steel are produced from old steel, the fact that cars, appliances, and bridges last a long time makes it necessary to continue to mine virgin ore to supplement the production of new steel. Economic expansion, domestically and internationally, creates additional demand that cannot be fully met by available scrap supplies.

Unlike other competing industries, recycled content in the steel industry is second nature. The North American steel industry has been recycling steel scrap for over 150 years through the 1,800 scrap processors and some 12,000 auto dismantlers. Many of them have been in the business for more than 100 years.

The pre-consumer, post-industrial, post-consumer, and total recycled content of steel products in the United States can be determined for the calendar year 2003 using information from the American Iron and Steel Institute (AISI), the Institute of Scrap Recycling Industries (ISRI), and the U.S. Geological Survey. Additionally, a study prepared for the AISI by William T. Hogan, S.A., and Frank T. Koelble of Fordham University is used to establish pre- and post-consumer fractions of purchased scrap.

Individual company statistics are not applicable or instructive because of the open loop recycling capability that the steel and iron industries enjoy, with available scrap typically going to the closest melting furnace. This open loop recycling allows, for example, an old car to be melted down to produce a new soup can, and then, as the new soup can is recycled, it is melted down to produce a new car, appliance, or perhaps a structural beam used to repair some portion of the Golden Gate Bridge.

Basic Oxygen Furnace

The basic oxygen furnace (BOF) facilities consumed a total of 15,772,900 tons of ferrous scrap in the production of 50,941,700 tons of liquid steel during 2003. Based on U.S. Geological Survey statistics, 1,738,800 of these ferrous scrap tons had been generated as unsalable steel product within the confines of these steelmaking sites. In the steel industry, these tons are classified as "home scrap," but are a mix of pre-consumer scrap and post-industrial scrap. Estimates by the Steel Recycling Institute identify about 80% of this home scrap as post-industrial scrap, equating to 1,391,000 tons (1,738,800 x 80%). Additionally, these operations reported that they consumed 148,800 tons of obsolete scrap (buildings and warehouses dismantled on-site at the mill) during this time frame. This volume is classified as post-consumer scrap.

For more information, please contact the Steel Recycling Institute at 1-412-922-2772, or visit us online at www.recycle-steel.org.

The New Steel — North America's #1 Recycled Material

As a result of the above, based on the total scrap con-

sumed, outside purchases of scrap equate to 13,885,300 tons [15,772,900 - (1,738,800 + 148,800)]. According to the Fordham University study, the post-consumer fraction of the purchased ferrous scrap would be 83.4 percent, while 16.6 percent of these purchases would be pre-consumer. This equates to 2,305,000 tons of pre-consumer scrap (13,885,300 x 16.6%). This "prompt scrap" is mainly scrap generated by manufacturing processes for products made with steel. It is also considered post-industrial scrap.

Therefore, the **total recycled content** to produce the 50,941,700 tons of liquid steel in the BOF is:

15,772,900 / 50,941,700 = 31.0%
(Total Tons Ferrous Scrap / Total Tons Liquid Steel)

Also, the **post-consumer recycled content** is:

(13,885,300 - 2,305,000) + 148,800 = 11,729,100
and
11,729,100 /50,941,700 = 23.0%
(Post-Consumer Scrap / Total Tons Liquid Steel)

Finally, the **post-industrial recycled content** is:

(1,391,000 + 2,305,000) / 50,941,700 =
3,696,000/ 50,941,700 = 7.3%
(Post-Industrial Scrap / Total Tons Liquid Steel)

Electric Arc Furnace

The electric arc furnace (EAF) facilities consumed a total of 44,661,700 tons of ferrous scrap in the production of 46,310,300 tons of liquid steel during 2003. Based on U.S. Geological Survey adjusted statistics, 12,124,000 of these ferrous scrap tons had been generated as unsalable steel product within the confines of these steelmaking sites. Again, in the steel industry, these tons are classified as "home scrap," but are a mix of pre-consumer scrap and post-industrial scrap. Estimates by the Steel Recycling Institute identify about 80% of this home scrap as post-industrial scrap, equating to 9,699,200 tons (12,124,000 x 80%). Additionally, these operations reported that they consumed 28,700 tons of obsolete scrap (buildings and warehouses dismantled on-site at the mill) during this time frame. This volume is classified as post-consumer scrap.

As a result , based on the total scrap consumed, outside purchases of scrap equate to 32,509,000 tons [44,661,700 - (12,124,000 + 28,700)]. According to the Fordham University study, the post-consumer fraction of the purchased ferrous scrap would be 83.4 percent, while 16.6 percent of these purchases would be pre-consumer. This equates to 5,396,500 tons of pre-consumer scrap (32,509,000 x 16.6%). This "prompt scrap" is mainly scrap generated by manufacturing processes for products made with steel. It is also considered post-industrial scrap.

Therefore, the **total recycled content** to produce the 46,310,300 tons of liquid steel in the EAF is:

44,661,700 / 46,310,300= 96.4%
(Total Tons Ferrous Scrap / Total Tons Liquid Steel)

Also, the **post-consumer recycled content** is:

(32,509,000 - 5,396,500) + 28,700 = 27,141,200
and
27,141,200 / 46,310,300 = 58.6%
(Post-Consumer Scrap / Total Tons Liquid Steel)

Finally, the **post-industrial recycled content** is:

(9,699,200 + 5,396,500) / 46,310,300 =
15,095,700 / 46,310,300 = 32.6%
(Post-Industrial Scrap / Total Tons Liquid Steel)

The above discussion and calculations demonstrate conclusively the inherent recycled content of today's steel in North America. To buy steel is to "Buy Recycled."

Understanding the recycled content of BOF and EAF steels, one should not attempt to select one steel producer over another on the basis of a simplistic comparison of relative scrap usage or recycled content. Rather than providing an enhanced environmental benefit, such a selection could prove more costly in terms of total life cycle assessment energy consumption or other variables. Steel does not rely on “recycled content” purchasing to incorporate or drive scrap use. It already happens because of the economics. Recycled content for steel is a function of the steelmaking process itself. After its useful product life, regardless of its BOF or EAF origin, steel is recycled back into another steel product. Thus steel with almost 100 percent recycled content cannot be described as environmentally superior to steel with 30 percent recycled content. This is not contradictory because they are both complementary parts of the total interlocking infrastructure of steelmaking, product manufacture, scrap generation and recycling. The recycled content of EAF relies on the embodied energy savings of the steel created in the BOF. Steel is truly the most recycled material.