

## The three Rs of sustainable steel

Reduce, reuse and recycle are the three Rs of sustainability. For decades, the steel industry has been reducing the need for raw materials and encouraging reuse of existing products. Steel is the world's most recycled material.

The world steel industry applies the principles of reduction, reuse and recycling in many ways, in order to improve the sustainability of the industry. This fact sheet outlines the achievements that the industry has made in each of the three Rs: reduce, reuse and recycle.

### Dramatically reduced need for raw materials

In the 1970s and 1980s, modern steel plants needed an average of 144 kg of raw materials to produce 100 kg of steel. With investments in research, technology improvements and good planning, the steel industry today uses only 115 kg of inputs to make 100 kg of steel – a 21% reduction.<sup>1</sup>

In 2008, the world steel industry produced over 1.3 billion tonnes of steel. It used 1.48 billion tonnes of raw materials, or 470 millions tonnes less than would have been needed to make the same volume of steel in the 1970s.<sup>2</sup> This equates to a saving of 1.12 billion tonnes of CO<sub>2</sub> emissions in 2008 alone.<sup>3</sup>

### Thinner, stronger steels reduce emissions

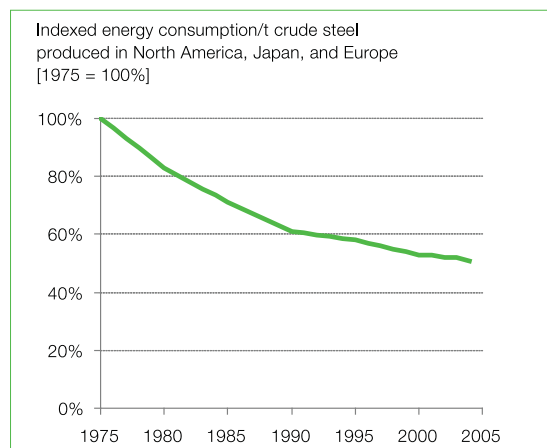
Steel industry innovation continues to produce new grades of steel, many of which are thinner but still offer the strength needed for the most demanding product applications. These new steels, called Advanced and Ultra High-Strength steels (AHSS and UHSS), allow customers, particularly automotive manufacturers to reduce mass of the vehicles by 17% to 25% while maintaining safety standards.<sup>4,5</sup>

Less mass means lower emissions from driving the vehicle. If the body structure of all cars produced worldwide (approximately 71 million in 2008<sup>6</sup>) were made of AHSS instead of conventional steel, this would result in total lifetime emission saving of 156 million tonnes CO<sub>2</sub> equivalents.

The vehicles are lighter because they use thinner and stronger steel grades. Today, more than 50% of the steel components in a vehicle are new high-strength steels. This reduced material need lowers emissions from steel production.

### Reducing energy use

From 1975 to 2005, the average energy consumption per tonne of crude steel produced decreased by about 50%.



Source: worldsteel, AISI, JISF and JFE, "Global steel sectoral approach", presentation in Washington, 2008

These improvements were achieved through:

- enhanced energy efficiency in the steelmaking process, the result of significant investments in R&D
- continuous efforts to implement incremental advances
- shared best practices
- more recycling of steel-containing products and better quality of recycled steels
- more use of by-products from steelmaking and yield increases.

### Reuse extends a product's life

Reuse is a key aspect of sustainability.<sup>7</sup> It applies to all materials, but the durability of steel makes reuse particularly relevant. Steel reuse can be described as any process where end-of-life steel is not re-melted but rather enters a new product use phase.

Many items made from steel are easily reused. For example, paper clips are used over and over again in homes and offices all over the world. Steel barrels, or drums, have a typical life of six months. If they are used 10 times, however, that lifespan can be extended to five years. It is the durability of the steel that enables these products to be reused.

In North America approximately 33% of the straight rail (sections of straight railway track) purchased comes from used rail that is disassembled at redevelopment sites. In 2007, approximately 1.4 million tonnes of steel rail were shipped to customers across the US.<sup>8</sup> Based on railroad industry reports, an estimated 1.46 million tonnes of straight rail were put into service, thus over 340,000 tonnes of straight rail were reused during this period.

Eliminating the need to produce 340,000 tonnes of new rail products equates to saving of 811,600 tonnes of CO<sub>2</sub>.

### The world's most recycled material

Of the three Rs, recycling is probably the most recognised attribute of steel. Steel scrap is re-melted and used to make new steel. In 2008, more than 475 million tonnes of steel scrap<sup>9</sup> was moved from the waste stream into the recycling stream. This is more than the combined reported totals for other recyclable materials, including paper, plastic, glass, copper, lead, and aluminum.<sup>10</sup>

Steel recycling began in the major cities of the 19th century. In the industrial centres of London, Hong Kong and New York, peddlers collected pots, pans and other metal products that contained valuable steel and sold them on for use in steel plants. This has evolved into the recycling infrastructure that services the world today.

The World Steel Association has estimated the recycling rates for products that contain a significant portion of steel, and identified target rates for 2050 (see Table 1).

**TABLE 1: STEEL INDUSTRY RECYCLING RATES**

Market	2007 (est.)	2050 Target
Construction	85%	90%
Automotive	85%	95%
Machinery	90%	95%
Appliances	50%	75%
Containers	69%	75%
Total	83%	90%

These goals, when accomplished, will result in an additional 38 million tonnes of steel being recycled worldwide by 2050. This equates to 68 million tonnes less CO<sub>2</sub>.

Steel recycling accounts for significant raw material and energy savings. Over 1,200 kg of iron ore, 7 kg of coal, and 51 kg of limestone are saved for a tonne of steel scrap used.

From an environmental point of view, steel recycling has an enormous impact on the reduction of CO<sub>2</sub> emissions. If 450 million tonnes of hot rolled steel were produced from 100% scrap rather than new materials, the total CO<sub>2</sub> savings would be approximately 811 million tonnes in one year.

### The impact of the three Rs on climate change

This fact sheet demonstrates how the steel industry is taking action to minimise its environmental footprint. The industry continues to evolve and aims to make steel the most innovative and sustainable material of the 21st century.

Last updated: September 2009

#### Footnotes

1. [www.sustainable-steel.org/matefficiency.html](http://www.sustainable-steel.org/matefficiency.html), accessed 28 September 2009
2. 'World Steel in Figures 2009', World Steel Association
3. Derived from the life cycle inventory (LCI) for steel, 2000 update, World Steel Association
4. ULSAB research (WorldAutoSteel), carmakers' own body structure designs
5. 'Determination of Weight Elasticity of Fuel Economy for Conventional ICE Vehicles, Hybrid Vehicles and Fuel Cell Vehicles', fka, June 2007
6. [www.ioca.net](http://www.ioca.net), accessed 28 September 2009
7. 'Recycling, reuse and the sustainability of steel', Louis Brimacombe, Nick Coleman and Colin Honess in Millennium Steel, 2005
8. American Iron and Steel Institute statistics
9. 'World Steel in Figures 2009', World Steel Association
10. 'Steel recycling on the rise', World Business Council on Sustainable Development, 2009