



The Steel Industry

The Steel Industry today is vital to both economic competitiveness and national security. Steel is the backbone of bridges, skyscrapers, railroads, automobiles, and appliances. Most grades of steel in use today – particularly high-strength steels that are lighter and more versatile – were not available ten years ago. Steel is the most recyclable and recycled material in North America, with an overall recycling rate of 66%

Source: eia.doe.gov

Steel Industry Type Facilities

- Integrated mills, which use ore, coke, limestone, energy, and water to make multiple products for a wide variety of markets
- Minimills, which use scrap steel to make a narrow list of products for multiple markets
- Finishing mills , which use intermediate steel products to make products for focused markets



TABLE 8.1-1
Water Use for Various Unit Operations in the Steel Industry

Process Area	Material Conditioning	Air Pollution Control	Heat Transfer	Unit Energy Consumption (Stubbles, 2000)	Recycled/ Re-used Fraction
Cokemaking	200 gallons per ton coke	250-300 gallons per ton coke	8,000 - 8,500 gallons per ton coke	5.1 MM BTU/ton coke	0% (newer plants may recycle cooling water)
Boilers for Converting Coke Oven Gas, Tars, and Light Oils			40,000 - 120,000 gallons per ton coke	7.5 MM BTU/ton coke exported energy in the form of gas, tars, and light oils	Varies depending on the age of the boilers
Sinter Plant	20 - 30 gallons per ton sinter	900 - 1,000 gallons per ton sinter	200 gallons per ton sinter	2.2 MM BTU/ton sinter	80%
Blast Furnace	100 - 200 gallons per ton molten iron	800 - 1,000 gallons per ton molten iron	2,500 - 3,000 gallons per ton molten iron	15.48 MM BTU/ton molten iron	90%
Boilers for Converting Blast Furnace Gas			20,000 - 60,000 gallons per ton molten iron	3.2 MM BTU/ton molten iron exported in the form of blast furnace gas	Varies depending on the age of the boilers
Basic Oxygen Furnace	100 - 200 gallons per ton liquid steel	800 - 1,000 gallons per ton liquid steel	2,500 - 3,000 gallons per ton liquid steel	1.17 MM BTU/ton liquid steel	50%
Direct Reduced Iron Processes	70 - 80 gallons per ton iron	negligible	200 - 250 gallons per ton iron	8.3 MM BTU/ton iron	~80%
Electric Arc Furnace	negligible	negligible	2,000 - 2,500 gallons per ton liquid steel	5.65 MM BTU/ ton liquid steel	80%
Continuous Caster	negligible	negligible	3,000 - 3,500 gallons per ton cast product	0.15 MM BTU/ton cast steel	70%
Plate Mill	1,000 - 2,000 gallons per ton plate	negligible	7,000 - 8,000 gallons per ton plate	3.0 MM BTU/ton plate product	30%
Hot Strip Mill	400 - 600 gallons per ton hot rolled strip	negligible	7,000 - 8,000 gallons per ton hot-rolled strip	2.2 MM BTU/ton hot-rolled strip	60%
Pickling	30 - 40 gallons per ton steel pickled	80 - 100 gallons per ton steel pickled	20 - 30 gallons per ton steel pickled	0.20 MM BTU/ton steel pickled	70%
Cold Rolling	50 - 100 gallons per ton cold-rolled strip	negligible	2,500 - 3,000 gallons per ton cold-rolled strip	4.2 MM BTU/ton cold-rolled strip	90%
Coating	60 - 70 gallons per ton coated steel	1 - 10 gallons per ton coated steel	1,200 - 1,800 gallons per ton coated steel	5 - 8 MM BTU/ton coated steel, depending on process and product	80%

MM BTU/ton = million British thermal units per ton.

Source: Compiled CH2M HILL client project data

Water Use Types

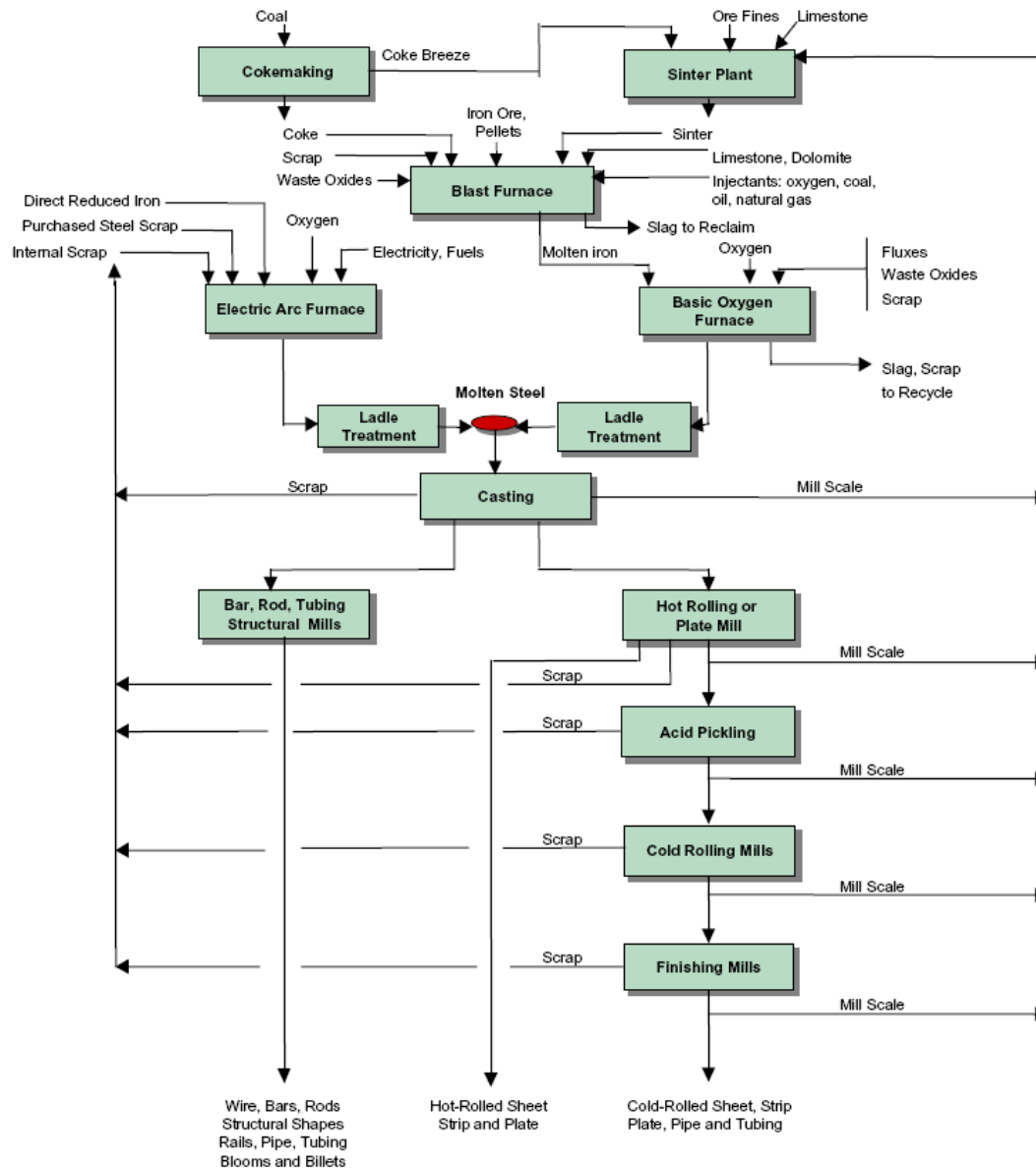
- Evaporative Losses
 - Slag quenching
 - Coke quenching
 - Spray chamber cooling
 - Cooling towers
- Products
 - Not part of products – but contained in spent pickle liquors

Water Use Types – Cont.

- Return Flows
 - Heat transfer from processes
 - Treating and washing products
- Contact Water
 - Contact cooling
 - Wet scrubbers for air pollution control
 - Coke oven gas treatment
 - others

Water Use Type - Continued

- Noncontact Water
 - Heat exchangers
 - Coke oven gas treatment
 - Blast furnaces, basic oxygen furnaces, electric arc furnaces, hot/cold rolling operations, others



Source:

Adapted from U.S. Council on Wage and Price Stability, Report to the President on Prices and Costs in the United States Steel Industry, 1977 (COWPS, October 1977)
 Reported in the Steel Industry Technology Roadmap, AISI, December 2001

Water Use By Operation

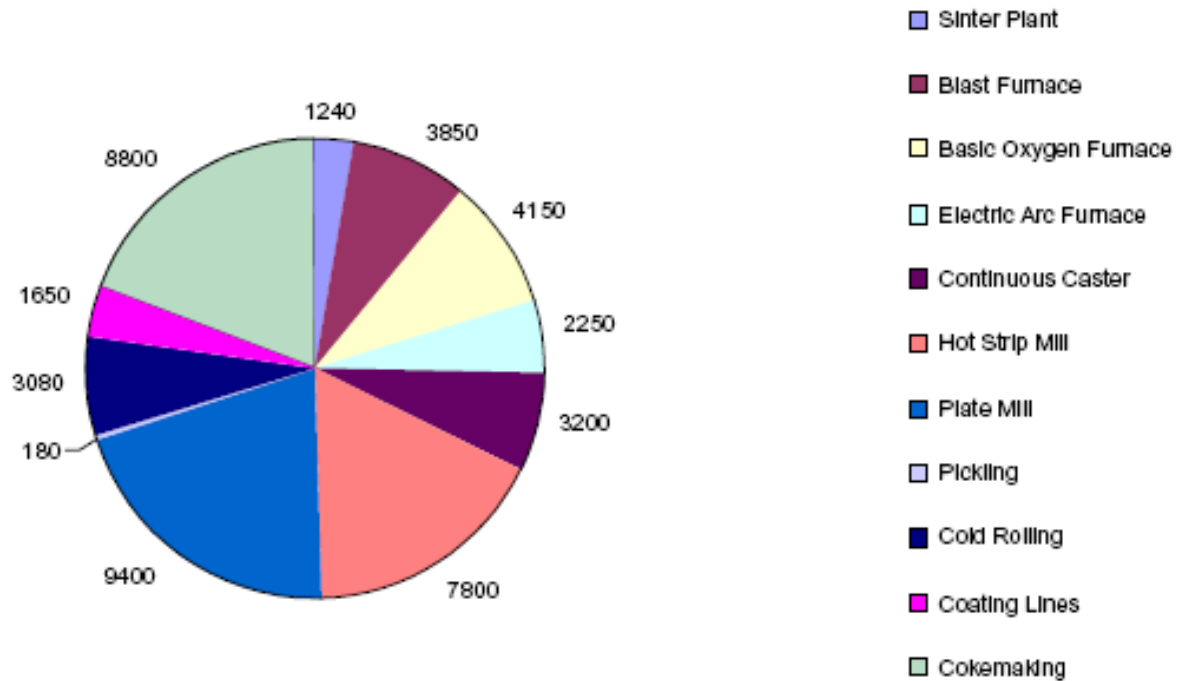


FIGURE 8.1-2
Water Use By Operation, Gallons per Ton of Production