

IRON AND STEEL

By Michael Fenton

Iron and steel are the basic metals of an industrial society and are vital to the United States for its national security and economic well-being. Although acceptable substitutes are available for many uses, they are not practical on a large scale at this time because of the cost and lack of availability of alternative materials. Data regarding U.S. production of iron and steel and shipments of steel mill products were reported by the American Iron and Steel Institute (AISI). These data can be regarded as representing 100% of the raw steel producers in the United States. World production of iron and steel is reported by the International Iron and Steel Institute (IISI) and by foreign government agencies. Consistent with international usage and Federal Government policy, the U.S. Geological Survey is reporting all data on iron and steel in metric units, unless otherwise noted.

Environment

The brownfield initiative of the Environmental Protection Agency (EPA) began in 1993 with the purpose of encouraging redevelopment of industrial and commercial sites. The term “brownfield” generally applies to abandoned, idled, or under used industrial and commercial facilities where expansion or redevelopment is complicated by real or perceived environmental pollution. Many brownfield sites are found throughout the United States. Some are abandoned steel plants, which continue to deteriorate in urban centers. These industrial properties, sometimes thousands of acres in size, are not easily sold for redevelopment because of continuing seller liability after environmental cleanup. By 1997, the EPA funded 77 brownfields-assessment pilot projects. Meanwhile, EPA policies were evolving to give States more flexibility in the approval process for clean-up and redevelopment of abandoned sites. In May 1997, the Brownfields National Partnership was formed to combine the resources of 15 federal agencies to further encourage brownfield redevelopment.

The EPA announced final rules to be effective in September, which changed the airborne particle standard from 10 microns (PM10) to 2.5 microns or smaller (PM2.5). According to the EPA, the PM10 standard does not protect against fine particles that lodge deep in the lungs, affecting especially asthmatics and children. The seriously affected steel plants would be those with electric furnaces that emit zinc and other metal dust from scrap feed and integrated mills having coking operations. The new standard is expected to cause some plants to use more direct-reduced iron (DRI) to avoid the zinc emission problem and to adopt cokeless ironmaking processes. The EPA also put into effect the final compliance-assurance-monitoring rule in October under Title 40 CFR, Part 64. The goal with the new rule was to provide reasonable assurance that mills comply with emission limits by monitoring its emission-control devices.

In the international accord reached in Kyoto during December 1997, the nations of the world agreed that developed nations should reduce their industrial emissions of carbon dioxide gas. Developing countries, such as China, the Republic of Korea, and India, would be exempt from this requirement, because according to these countries, their growing economies would be jeopardized. The United States agreed to reduce its gas emissions by 7% below 1990 levels by 2012. Germany and Japan agreed to reduce emissions by 25% and 6%, respectively, by 2005. Many steelmakers in the developed nations claimed that steelmakers in the developing nations would have an unfair competitive advantage. Proposed carbon-based emission taxes are expected by steelmakers in developed countries to drain financial resources, thereby adversely affecting investment programs and research and development aimed at making improvements in energy efficiency and other environmental areas. As an alternative to mandated reductions by Government, United States steel companies proposed a voluntary plan to reduce gas emissions by 10% by the year 2010. This would be accomplished gradually through the use of new technology, more effective use of materials, and improvement of efficiency of existing energy-producing processes.

Production

Production of raw steel in the United States increased significantly to 98.5 million metric tons from 95.5 million tons in 1996. AISI estimated raw steel production capability to be 110.1 million tons, up from 105.3 million tons in 1996. Production represented 89.4% of estimated capability, compared with 90.7% in 1996.

Integrated steel producers smelt iron ores to liquid iron in blast furnaces and use basic oxygen furnaces to refine this iron with some scrap to produce raw liquid steel. The basic oxygen process was used to make 55.4 million tons of steel. The use of this process declined slightly, from 57.4% of total steel production in 1996 to 56.2% in 1997. The integrated steel industry in the United States consisted of 15 companies operating ironmaking and steelmaking facilities at 23 locations. Several of these companies also operated nonintegrated plants and/or other steelmaking facilities at the same locations.

Minimills and specialty mills are nonintegrated steel producers. Minimills produce a limited product line. These plants always incorporate electric arc furnaces (EAF) to melt low-cost raw materials (usually scrap), continuous casting machines, and a hot rolling mill that is often closely coupled to the casting operation. Specialty mills include producers of stainless, alloy-electrical, and tool steel; high-temperature alloys; forged ingots; and other low-volume steel products.

The EAF steelmaking process was used to produce 43.1 million

tons of steel, an increase of nearly 6% over that of 1996, and accounted for 43.8% of total steelmaking. Overall, the nonintegrated sector of the industry consisted of more than 65 companies having more than 90 steelmaking plants.

Raw liquid steel is mostly cast into semifinished products in continuous casting machines. Only 5.2% of U.S. production was cast in ingot form and subsequently rolled into semifinished forms; this represents a decrease of 6.8% from that in 1996. Continuous casting production was 93.3 million tons, or 94.7% of total steel production, compared with 89 million tons and 93.2% in 1996.

Consumption

“Steel mill products” are produced at a steel mill, either by forging or rolling, in forms normally delivered for fabrication or use. Some companies purchase semifinished steel mill products from other steel companies and use them to produce finished steel products. To avoid double counting steel mill product shipments under these circumstances, steel mills identify any shipments of steel mill products to other companies that are reporters of steel mill product shipments. The accumulated shipments of all companies less the shipments to other reporting companies are identified as “net” shipments.

The 6-year trend of steadily increasing net shipments of steel products to satisfy domestic demand continued; in fact, the amount of products shipped was the highest in 23 years. Shipments of steel mill products by U.S. companies increased 4.9%, to 96 million tons. Export shipments by AISI reporting companies increased from 4.56 million tons in 1996 to 5.47 million tons. Shipments to domestic customers rose 4% during 1997. Shipments to the oil and gas, mining, quarrying, and lumbering industries increased 20%, while shipments by makers of construction products increased 2%. Steel service center shipments increased 2.5%, while distribution and manufacture of appliances declined 5%. Shipments of industrial and agricultural machinery, equipment, and tools increased by 1%. Manufacture of automobiles, the largest single end-use market, increased 4%. Containers, packaging, and shipping materials remained almost unchanged.

Prices

The Bureau of Labor Statistics Producer Price Index for steel mill products was up less than 1%, from 115.6 (revised) in 1996 to 116.4 (1982 base=100). The index rose during the first quarter, declined slightly, and then rose to a high of 116.8 in September before declining to 166.2 at year end.

Foreign Trade

Exports of steel mill products increased to 5.5 million tons from 4.6 million tons in 1996. Canada again received the largest amount of U.S. exported steel, 2.2 million tons, essentially the same as that of 1996. Mexico was again in second place, receiving nearly 1 million tons. Imports of steel mill products increased by nearly 7% to 28.3 million tons, from 26.5 million tons in 1996. Brazil, Canada, the European Union (EU), Japan, the Republic of

Korea, Mexico, and Russia were major sources of steel mill product imports.

Despite rising domestic steel mill capacity, imports of steel mill products have nearly doubled since 1991. During the same period, imports of semifinished steel increased 158%. Domestic producers have been unable to keep up with demand for semifinished products and finished steel, while an unfavorable currency exchange rate has made foreign steel prices much more competitive. While U.S. steelmakers have viewed imported finished steel as competing directly with domestic products, imports of semifinished products have not been perceived as a rival. This dichotomy is based on the need for imported semifinished steel to make up for the domestic shortage of hot metal capacity in order to satisfy the U.S. market demand for finished steel mill products.

From 1992 through 1994, total imports of semifinished steel trended upward. These imports were comprised mostly of ingots, blooms, billets, and slabs for rolling, believed to have been imported by U.S. steel companies to supplement steelmaking capacity, but also included imports by companies that do not produce raw steel. This rising trend ended temporarily in 1995, declining 35% to 4.7 million tons from the 1994 high of about 7.2 million tons. During 1996, imports resumed their upward trend, increasing to 6.8 million tons, only to decline again during 1997 to 5.7 million tons as domestic steelmaking capacity increased.

Imports of semifinished steel by steel companies must be taken into consideration in evaluating apparent consumption (supply) of steel mill products in the United States and the share of the market represented by imported steel. To avoid double counting the imported semifinished steel and the products produced from it, the amount of semifinished steel consumed by companies that also produce raw steel must be subtracted from domestic consumption. For 1997, this amount was estimated to have been 4.5 million tons. For 1993, 1994, 1995, and 1996, the annual imports were estimated to be 2.5 million, 5 million, 2.5 million, and 5 million tons, respectively. Prior to 1993, the annual amount was less than 0.2 million tons. Taking the imported semifinished steel into consideration, the share of the U.S. steel market represented by imported steel was an estimated 25% in 1997, compared with 24% in 1996.

Regarding the reporting of imports and exports, “fabricated steel products” are produced from steel mill products, but do not include products that incorporate steel products with other materials. Examples of fabricated steel products are fabricated structural steel and steel fasteners. “Other iron and steel products” refer to products that are not produced from steel mill products. Examples of other iron and steel products include iron or steel castings and DRI.

The AISI reported an indirect steel-trade surplus of 1.1 million tons in 1997, the first surplus since AISI began tracking the measurement in 1984, and perhaps the first one since the late 1970’s (New Steel, 1998). The measurement (imports and exports of steel-containing products by world areas and steel-consuming markets, expressed in tons of steel) accounts for virtually all products made with steel such as automobiles, machine tools, and appliances. According to AISI, this surplus, when compared with the 1986 indirect steel trade deficit of 8.4 million tons, confirmed that U.S. manufacturers were among the world’s most competitive

producers of high-quality, steel-containing goods in 1997, after an impressive revitalization of U.S. manufacturing since the mid-1980's.

Some domestic steelmakers registered dissatisfaction concerning import activity that they characterized as unfair trade practices. During November 1996, Geneva Steel Co. and Gulf States Steel Inc. filed antidumping petitions with the U.S. Department of Commerce and the U.S. International Trade Commission (ITC) against imports of cut-to-length carbon plate from China, Russia, South Africa, and Ukraine. In December 1997, the ITC ruled that cut-to-length carbon plate imports had caused material injury to domestic producers (Kelly, 1997). Anti-dumping duty margins set earlier by the Commerce Department on these imports became effective after this ruling.

In July 1997, three U.S. companies filed a trade case requesting antidumping duties against stainless rod producers in Germany, Italy, Japan, the Republic of Korea, Spain, Sweden, and Taiwan. Later, the Specialty Steel Industry of North America complained that specialty steel imports were causing injury to U.S. producers. In a preliminary finding, the ITC ruled in favor of the U.S. companies. In a similar case, the ITC ruled in December that economic problems experienced by U.S. makers of carbon wire rod could not be blamed on imports.

World Review

World production of pig iron totaled about 549 million tons, a 4% increase over that of 1996. In Asia, China continued to be the leading producer of pig iron in the world, producing more than 115 million tons, an almost 8% increase over that of 1996. Japan and the United States followed with 79 million and 50 million tons, respectively. The Republic of Korea's production declined slightly. Russia and Ukraine were the only major pig iron producers in the Commonwealth of Independent States (CIS). Production in Russia increased slightly over that of 1996, but production was still less than that of 1995. Production in Ukraine was 13% greater than that of 1996. In North America, the only major producer of pig iron was the United States, where production was only slightly greater than that of 1996. In South America, the only major pig iron producer was Brazil, producing about 25 million tons. Germany was the top producer in the EU with a 3% increase to nearly 31 million tons. Italy increased production by nearly 10%.

DRI production worldwide was about 33.5 million tons, a slight increase from that of 1996, but a 43% increase since 1993. The leading technology was the Midrex process, followed by the HYL III and the HYL I processes. Demand for charge materials and the growth of thin slab casting continued to cause an increased interest in DRI by steel producers. Direct reduction of iron ore proved to be a cost-effective way to encourage economic growth in developing countries, especially those with an abundance of natural gas. The leading producer continued to be Venezuela, followed by India, Mexico, and Iran. World capacity for DRI production was estimated to be nearly 38 million tons per year. Additional DRI capacity of nearly 12 million tons was under construction in India, Mexico, Russia, Saudi Arabia, Trinidad and Tobago, the United States, and Venezuela. After the addition of several DRI plants, India's capacity exceeded 5 million tons per

year.

World production of crude steel was about 795 million tons, a 5% increase from the 755 million tons (revised) produced during 1996. As in previous years, production varied widely among major regions of the world. Asian countries produced 39% of the world's steel; the European Union, 20%; and North America, 16%. During 1997, China was again the world's leading steel producer, reaching 107.6 million tons, a gain of more than 6% over that of 1996. The leading producers behind China, in declining order, were Japan, the United States, Russia, and Germany. These five countries accounted for about one-half of world production. The combined steel production of the eight steel-producing States in the CIS was 79 million tons, an increase of nearly 4% compared with that of 1996. Russia and Ukraine remained the top producers. Production in Russia resumed its 3-year downward trend of 1992-94 after a 5% increase in 1995. Ukrainian production increased 12% above its 1996 level.

Outlook

As 1997 ended, the United States was experiencing remarkable economic growth and prosperity. The global economy was expected to continue growing as interest and inflation rates remain stable or decline, and as the sizes of the economies of developing countries grow. For perspective, the U.S. economy has enjoyed only two longer expansions since World War II; the 106-month expansion from February 1961 to December 1969 and the 92-month expansion from November 1982 to July 1990 (Garino, 1998). The end of the first-quarter 1991 marked the beginning of the current 81-month period of economic growth, during which U.S. industry, including the steel and steel scrap recycling sectors, successfully met the challenges of domestic demand and global competition by adopting new technologies, downsizing (including mergers and acquisitions), and emphasizing customer satisfaction. New and replacement infrastructure needs were being satisfied, and usage of steel in the automotive, construction, and beverage container industries was increasing, as demand for durable goods by the public increased.

As the months of this nearly unprecedented economic growth passed and increasing numbers of industry observers were beginning to wonder how long this prosperity would last, southeast Asia's economy experienced a surprising shock. In July 1997, Thailand devalued its currency by abandoning the traditional fixed ratio of the baht to the U.S. dollar, which adversely affected the currencies of Indonesia, the Republic of Korea, Malaysia, the Philippines, and Taiwan. After a decade of virtually unrestrained and largely unregulated growth, the regional economy of southeast Asia, including Japan, was in serious trouble. At this point, the focus in the United States was redirected from concerns about the length of this long period of prosperity to when and how the U.S. economy would be adversely affected by Asia's financial crisis. By yearend, the consensus of opinion was optimistic and long-term growth with low inflation in the United States was predicted. Problems in southeast Asia were not expected to cause a recession in the United States.

Observers of the global and the United States steel industries were generally optimistic, although they were more restrained in making predictions. The Organization for Economic Co-operation

and Development predicted continuing strong global demand for steel products, with growth in 1998, but at a slower rate than that of 1997 (Organization for Economic Co-operation and Development, 1997, Steel market continues to surge, accessed January 20, 1998, at URL <http://www.oecd.org/news-and-events/release/nw97102a.htm>). Canada would experience a significant expansion, but steel demand would weaken somewhat in 1998. In the United States and Mexico, the current economic expansions were expected to continue, with strong demand for steel products.

After the beginning of the financial crisis of southeast Asia, the IISI revised its short range global forecast of steel consumption to a level slightly lower than that of 1997 (International Iron and Steel Institute, 1998, Short range outlook for steel demand, accessed June 26, 1998 at URL <http://www.worldsteel.org/steelnews/apr98short.htm>). Steel demand in Australia, China, the European Union, North America, and South America was predicted to be strong during the early part of 1998, followed by a gradual softening. Steel demand in India was expected to remain strong during 1998, while that of Indonesia, Japan, and the Philippines would remain depressed.

U.S. minimills began as small, simple, inexpensive, lightly manned producers of carbon steel, mostly long products, that used local sources of scrap for feedstock for local distribution. Significant progress has been made by some minimills toward the production of steel products that formerly only integrated producers could make. Minimills are now competing with integrated producers at the highest quality levels in all long-product markets. In fact, some new minimills are producing hot-rolled thin and “ultra-thin” flat products, which no one would have predicted a few years ago. Steelmakers realize that they are in a global economy in which they must improve their operating efficiency and product quality while lowering cost, or they will lose market share. One incentive to produce higher-quality steel is that it allows the steelmaker the opportunity to enter new markets, such as the automotive market. Ford Motor Co. bought nearly 8,000 tons of hot-rolled sheet per month from minimills in 1997 with the expectation of increasing purchases to 25,000 tons per month by 2000. General Motors may eventually buy from minimills provided the quality of their automotive-grade sheet for exposed applications improves.

In contrast to minimills, integrated steel plants are large, complex, capital and labor intensive, multiproduct enterprises that use raw materials from diverse and distant sources to make a wide range of products for domestic and foreign markets. In the *Steel Industry Technology Roadmap*, a report compiled by representatives from steel companies, the Department of Energy, the American Iron and Steel Institute, the Steel Manufacturers Association, and universities, predicted that many smaller older blast furnaces will be shut down while productivity in the larger furnaces will be increased (33 Metalproducing, 1997). Because of the \$200 million to \$300 million cost, it is not likely that a new blast furnace will be built in the United States (Hogan, 1996). Iron

production from currently remaining blast furnaces will decline to about 40 million tons from about 25 blast furnaces by 2015. Coal, oxygen, and natural gas injection will increase and may supply up to 50% of the total furnace energy requirements, as average coke rates drop from 380 to 295 kilograms per ton of hot metal. Also, blast furnace repair costs will be reduced.

The outlook for cokemaking and, in turn, blast-furnace ironmaking is extremely uncertain. In the future, it may be impossible to operate using currently available operating and control technologies (Hogan and Koelble, 1996). The increasing usage during the past decade of injection and the decline of coke production has been a response to environmental regulation (Clean Air Act). Since mid-1988, the number of active batteries has declined to 78; the number of ovens to 4,321. Active coke making capacity has fallen by 5.9 million tons to a current level of 22.7 million annual tons in 1997. The loss of 15 active batteries of 1,126 ovens since mid-1988 has contributed to cokemakers' difficulties in meeting demand in recent years. U.S. cokemakers may be forced to make additional, possibly major cuts in capacity. The severity of the cuts will depend significantly on how stringent rules are, which will be based on minimizing the risk to public in surrounding communities.

The distinction between these two types of steelmakers will become increasingly blurred as the integrated companies reduce costs of labor, capital, and operations and the minimills become more capital intensive; increase costs; invest in sources of iron units, such as DRI, as alternatives to scrap; and produce a wider range of high-quality flat and long products. Garvey (1996) has predicted that only three integrated companies and only six or seven minimills will serve the vast majority of steel consumers in 10 years. Minimills will become more integrated as they engage in mergers, joint ventures, and acquisitions upstream for greater control of raw materials and downstream for steel finishing capability. Pinkham (1997) suggests that a third form of steelmaker may emerge and perhaps dominate the market. A hybrid would consist of an electric arc furnace operation which would also utilize the oxygen-blowing of an integrated steelmaker. Such a furnace is operating at Nucor Corp.'s Berkeley, SC, plant. The hybrid plant would concentrate on hot-rolled flat products and special bar quality steel, while the integrated plants would produce flat-rolled products, especially cold-roll, and the minimills would focus on long products, especially rebar and structural steel.

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TABLE 1
SALIENT IRON AND STEEL STATISTICS 1/

(Thousand metric tons)

	1993	1994	1995	1996	1997
United States:					
Pig iron:					
Production 2/	48,200	49,400	50,900	49,400	49,600
Exports 3/	27	56	56	60	86
Imports for consumption 3/	828	2,500	2,360	2,660	3,150
Direct-reduced iron:					
Production 4/	440	480	460	450	510
Exports 3/	17	18	5	3	8
Imports for consumption 3/	1,090	1,170	1,190	1,050	1,990
Raw steel production: 5/					
Carbon steel	78,800	81,200	84,000	84,900	87,000
Stainless steel	1,770	1,840	2,050	1,870	2,160
All other alloy steel	8,220	8,180	9,080	8,710	9,290
Total	88,800	91,200	95,200	95,500	98,500
Capability utilization, percent	89.1	93.0	93.3	90.7	89.4
Steel mill products:					
Net shipments 2/	80,800	86,300	88,400	91,500	96,000
Exports 5/	3,600	3,470	6,420	4,560	5,470
Imports 5/	17,700	27,300	22,100	26,500	28,300
Producer price index for steel mill products 6/ (1982=100.0)	108.2	113.4	120.1	115.6 r/	116.4
World production: 7/					
Pig iron	507,000	516,000	533,000	528,000 r/	551,000
Direct-reduced iron 4/	23,500 r/	27,700 r/	31,100 r/	32,700 r/	34,700 e/
Raw steel	730,000	730,000	757,000 r/	755,000	795,000 e/

e/ Estimated. r/ Revised.

1/ Data are rounded to three significant digits, except prices; may not add to totals shown.

2/ Data from American Iron and Steel Institute (AISI).

3/ Data from Bureau of the Census.

4/ Data from Midrex Direct Reduction Corporation.

5/ Raw steel is defined by AISI as steel in the first solid state after melting, suitable for rolling.

6/ Data from Bureau of Labor Statistics.

7/ Data from U.S. Geological Survey and International Iron and Steel Institute.

TABLE 2
MATERIALS CONSUMED IN BLAST FURNACES AND PIG IRON PRODUCED 1/

(Thousand metric tons)

Material	1996	1997
Iron oxides: 2/		
Ores	862	1,540
Pellets	64,900	64,400
Sinter 3/	11,600	11,300
Total	77,400	77,200
Scrap 4/	1,720	1,720
Coke 2/	20,600	22,100
Pig iron produced	49,400	49,600

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ American Iron and Steel Institute.

3/ Includes sintered ore and pellet fines, dust, mill scale, and other revert iron-bearing materials; also some nodules.

4/ Mainly briquetted turnings and borings, shredded scrap, etc.; scrap produced at blast furnaces and remelt not included.

TABLE 3
DISTRIBUTION OF SHIPMENTS OF STEEL MILL PRODUCTS, BY STEEL TYPE, PRODUCT,
AND MARKET 1/

	Thousand metric tons		Percent	
	1996	1997	1996	1997
Shipments by steel type:				
Carbon steel	84,400	88,400	92.2	92.1
Alloy steel	5,400	5,700	5.9	5.9
Stainless steel	1,730	1,880	1.9	2.0
Total	91,500	96,000	100.0	100.0
Steel mill products:				
Ingots, blooms, billets and slabs	2,090	2,380	2.29	2.47
Wire rods	4,620	4,810	5.05	5.01
Structural shapes-heavy	5,170	5,150	5.65	5.36
Steel piling	399	324	.44	.34
Plates-cut lengths	5,010	4,920	5.48	5.12
Plates-in coils	2,860	3,120	3.12	3.25
Rails	544	663	.59	.69
Railroad accessories	109	131	.12	.14
Bars-hot-rolled	6,350	7,400	6.94	7.70
Bars-light-shaped	2,110	2,320	2.30	2.42
Bars-reinforcing	5,230	5,610	5.71	5.85
Bars-cold finished	1,530	1,640	1.67	1.71
Tool steel	61	57	.07	.06
Pipe and tubing-standard pipe	1,400	1,390	1.53	1.45
Pipe and tubing-oil country goods	1,630	1,990	1.78	2.07
Pipe and tubing-line pipe	1,080	1,270	1.18	1.32
Pipe and tubing-mechanical tubing	954	1,060	1.04	1.10
Pipe and tubing-pressure tubing	35	35	.04	.04
Pipe and tubing-stainless	25	30	.03	.03
Pipe and tubing-structural	180	128	.20	.13
Pipe for piling	43	44	.05	.05
Wire	592	561	.65	.58
Tin mill products-blackplate	296	296	.32	.31
Tin mill products-tinplate	2,490	2,480	2.72	2.58
Tin mill products-tin-free steel	840	826	.92	.86
Tin mill products-tin coated sheets	97	82	.11	.09
Sheets-hot-rolled	15,800	16,500	17.31	17.20
Sheets-cold-rolled	12,800	12,100	13.97	12.60
Sheets and strip-hot dip galvanized	10,400	11,300	11.36	11.80
Sheets and strip-electrogalvanized	3,350	3,460	3.66	3.60
Sheets and strip-other metallic coated	1,600	1,860	1.75	1.94
Sheets and strip-electrical	417	463	.46	.48
Strip-hot rolled	520	737	.57	.77
Strip-cold rolled	871	915	.95	.95
Total	91,500	96,000	100.00	100.00
Shipments by markets:				
Service centers and distributors	24,600	25,200	26.89	26.30
Construction	14,100	14,400	15.43 r/	15.00
Automotive	13,300	13,800	14.54	14.40
Machinery	6,880	6,730	7.52	7.01
Containers	3,720	3,780	4.07	3.93
All others	28,900	32,100	31.56 r/	33.40
Total	91,500	96,000	100.00	100.00

r/ Revised.

1/ Data are rounded to three significant digits; may not add to totals shown.

Source: American Iron and Steel Institute.

TABLE 4
U.S. IMPORTS AND EXPORTS OF STEEL MILL PRODUCTS, BY COUNTRY 1/

(Thousand metric tons)

Country	1996		1997	
	Imports	Exports	Imports	Exports
Argentina	99	6	139	29
Australia	--	13	399	15
Brazil	2,560	18	2,590	24
Canada	4,450	2,170	4,330	3,340
China	434	39	433	14
European Union	7,990	320	6,790	242
Finland	196	1	158	1
Japan	1,820	63	2,320	13
Korea, Republic of	1,250	169	1,490	21
Mexico	2,640	958	3,000	1,000
Russia	1,510	--	3,010	--
South Africa	(2/)	21	285	3
Sweden	263	3	218	2
Taiwan	88	133	171	11
Trinidad and Tobago	(2/)	--	(2/)	--
Turkey	289	--	52	--
Ukraine	729	--	63	--
Venezuela	(2/) r/	59	401	103
Other	2,150	590	2,420	655
Total	26,500	4,560	28,300	5,470

r/ Revised.

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Unable to distinguish country breakdown. Included with "Other."

Source: American Iron and Steel Institute.

TABLE 5
U.S. EXPORTS OF IRON AND STEEL PRODUCTS 1/

(Thousand metric tons)

	1996	1997
Steel mill products:		
Ingots, blooms, billets, and slabs	282	191
Wire rods	95	77
Structural shapes-heavy	319	417
Steel piling	31	19
Plates-cut lengths	180	288
Plates-in coils	212	419
Rails-standard	37	47
Rails-other	10 r/	20
Railroad accessories	19	17
Bars-hot-rolled	319	377
Bars-light-shaped	105	108
Bars-concrete reinforcing	97	163
Bars-cold-finished	86	97
Tool steel	8	13
Pipe and tubing-standard pipe	70	65
Pipe and tubing-oil country goods	273	267
Pipe and tubing-line pipe	203	446
Pipe and tubing-mechanical tubing	11	16
Pipe and tubing-stainless	21	29
Pipe and tubing-nonclassified	227	291
Pipe and tubing-structural	41	104
Pipe for piling	4	9
Wire	96	124
Tin mill products-blackplate	5	7
Tin mill products-tinplate	323	324
Tin mill products-tin-free steel	54	40
Sheets-hot-rolled	433	335
Sheets-cold-rolled	462	474
Sheets and strip-hot-dip galvanized	94	129
Sheets and strip-electrogalvanized	137	168
Sheets and strip-other metallic coated	98	121
Sheets and strip-electrical	36	46
Strip-hot-rolled	42	69
Strip-cold-rolled	137	157
Total	4,560	5,470
Fabricated steel products:		
Structural shapes-fabricated	203	261
Rails-used	17	34
Railroad products	38	44
Wire rope	11	15
Wire-stranded products	21	26
Wire-other products	12 r/	13
Springs	60 r/	80
Nails and staples	23	33
Fasteners	447	482
Chains and parts	23	29
Grinding balls	31	29
Pipe and tube fittings	28	36
Other 2/	50 r/	53
Total	964 r/	1,140
Grand total	5,530 r/	6,610
Cast iron and steel products:		
Cast steel pipe fittings	107	94
Cast iron pipe and fittings	24	26
Cast steel rolls	15	17
Cast grinding balls	28	30
Granules-shot and grit	25	26
Other castings	41	50
Total	240	243

See footnotes at end of table.

TABLE 5--Continued
U.S. EXPORTS OF IRON AND STEEL PRODUCTS 1/

r/ Revised.

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Includes shapes-cold formed, sashes and frames, fence and sign post, and architectural and ornamental work, and conduit.

Source: American Iron and Steel Institute.

TABLE 6
U.S. IMPORTS OF MAJOR IRON AND STEEL PRODUCTS 1/

(Thousand metric tons)

	1996	1997
Steel mill products:		
Ingots, blooms, billets and slabs	6,830	5,770
Wire rods	1,770	2,030
Structural shapes-heavy	933	933
Steel piling	62	102
Plates-cut lengths	1,710	1,260
Plates-in coils	1,200	1,410
Rails and railroad accessories	183	216
Bars-hot-rolled	1,070	1,170
Bars-light-shaped	143	182
Bars-reinforcing	528	636
Bars-cold-finished	236	279
Tool steel	124	119
Pipe and tubing-standard pipe	686	675
Pipe and tubing-oil country goods	210	374
Pipe and tubing-line pipe	554	832
Pipe and tubing-mechanical tubing	298	355
Pipe and tubing-pressure tubing	44	35
Pipe and tubing-stainless	51	49
Pipe and tubing-nonclassified	12	12
Pipe and tubing-structural	349	403
Pipe for piling	7	13
Wire	507	594
Tin mill products-blackplate	120	181
Tin mill products-tinplate	250	260
Tin mill products-tin-free steel	154	137
Sheets-hot-rolled	3,760	4,630
Sheets-cold-rolled	2,680	3,350
Sheets and strip-hot-dip galvanized	1,420	1,660
Sheets and strip-electrogalvanized	144	180
Sheets and strip-other metallic coated	107	103
Sheets and strip-electrical	99	101
Strip-hot-rolled	55	58
Strip-cold-rolled	165	171
Total	26,500	28,300
Fabricated steel products:		
Structural shapes-fabricated	234	314
Rails-used	248	328
Railroad products	53	53
Wire rope	82	98
Wire-stranded products	136	156
Springs	288	319
Nails and staples	367	389
Fasteners	837	801
Chains and parts	90	99
Pipe and tube fittings	106	112
Other	237	263
Total	2,680	2,930
Grand total	29,100	31,200
Cast iron and steel products:		
Cast steel pipe fittings	36	34
Cast iron pipe and fittings	45	44
Other products	251 r/	297
Total	332 r/	375

r/ Revised.

1/ Data are rounded to three significant digits; may not add to totals shown.

Source: American Iron and Steel Institute.

TABLE 7
U.S. IMPORTS OF STAINLESS STEEL 1/

(Metric tons)

Product	1996	1997
Semifinished	102,000	76,000
Plate	127,000	128,000
Sheet and strip	344,000	365,000
Bars and shapes	91,000	108,000
Wire and wire rods	75,300	93,400
Pipe and tube	51,300	49,000
Total	791,000	819,000

1/ Data are rounded to three significant digits; may not add to totals shown.

Source: American Iron and Steel Institute.

TABLE 8
U.S. SHIPMENTS OF IRON AND STEEL CASTINGS 1/

(Thousand metric tons)

	1996	1997
Ductile iron castings	3,910 r/	3,930
Gray iron castings	5,620 r/	5,610
Malleable iron castings	238	246
Steel castings	1,150 r/	1,100
Steel investment castings	81	86
Total	11,000 r/	11,000

r/ Revised.

1/ Data are rounded to three significant digits; may not add to totals shown.

Source: Bureau of the Census.

TABLE 9
COAL AND COKE AT COKE PLANTS 1/ 2/

(Thousand metric tons)

	1996	1997
Coal, consumption	28,800	26,700
Coke: 3/		
Production	20,900	20,100
Exports	1,020	755
Imports	1,010	1,420
Consumption, apparent	20,900	20,700

1/ Data are rounded to three significant digits.

2/ Includes furnace and merchant coke plants.

3/ Coke production and consumption do not include breeze.

Source: Energy Information Administration, Quarterly Coal Report (DOE/EIA-0121).

TABLE 10
 PIG IRON AND DIRECT-REDUCED IRON: WORLD PRODUCTION, BY COUNTRY 1/ 2/ 3/ 4/

(Thousand metric tons)

Country 5/	1993	1994	1995	1996	1997
Albania e/	10	10	10	10	10
Algeria	925	919	940	800 t/	700 e/
Argentina:					
Pig iron	984	1,410 t/	1,568 t/	1,966 t/	2,066
Direct-reduced iron	1,156	1,269 t/	1,328 t/	1,422 t/	1,501
Australia	6,714	7,466	7,476	7,774 t/	7,884
Austria	3,390	3,362	3,838	3,416 t/	3,500 e/
Belgium	8,178	8,974	9,199	8,628 t/	8,077
Bosnia and Herzegovina e/	100	100	100	100	100
Brazil:					
Pig iron	23,982	25,177	25,090	24,121 t/	25,000 e/
Direct-reduced iron	250	220	300	340	320
Bulgaria	998	1,442	1,607	1,513	1,644
Burma:					
Pig iron e/	1 t/ 6/	1	2	2	2
Direct-reduced iron	20	10	20	20 e/	40
Canada:					
Pig iron	8,633	8,150	8,464	8,638 t/	8,679
Direct-reduced iron	740	770	1,010	1,420 t/	1,390
Chile	917	886 t/	855 t/	996 t/	943
China 7/	87,390	97,410 t/	105,293 t/	107,225 t/	115,440
Colombia	238	245	282	274 t/	388
Croatia e/	40	--	--	--	--
Czech Republic	4,668	5,287	5,289	4,898 t/	5,200 e/
Egypt:					
Pig iron	1,326	1,148	1,062	1,050 e/	1,000 e/
Direct-reduced iron	837	774	860	830	1,190
Finland	2,535	2,597	2,242	2,457 t/	2,500 e/
France	12,679	13,293	12,860 t/	12,108 t/	13,424
Georgia	88	--	--	--	-- e/
Germany:					
Pig iron	26,970	29,923	29,828	30,012 t/	30,939
Direct-reduced iron	180	280	410	370	380 e/
Hungary	1,407	1,590	1,515 t/	1,496 t/	1,141
India:					
Pig iron	15,674	17,808	18,626	20,000 e/	20,000 e/
Direct-reduced iron	2,208	3,122	4,280	4,830	4,900 e/
Indonesia: Direct-reduced iron	1,500	1,620	1,860	1,800	1,600
Iran:					
Pig iron	1,961	1,883	1,532	1,867	2,150
Direct-reduced iron	1,631 t/	2,861 t/	3,301	3,778	4,380
Italy	11,066	11,157	11,684	10,347 t/	11,348
Japan	73,738	73,776	74,905	74,597	78,519
Kazakstan	3,544	2,432	2,528	2,536	3,000 e/
Korea, North e/	6,600	6,600	6,600	6,600	6,600
Korea, Republic of	22,000 e/	21,169	22,344	23,010	22,712
Libya: Direct-reduced iron	944	852	970	862	990
Luxembourg 8/	2,411	1,927	1,028	829 t/	437
Macedonia e/	20	20	20	20	20
Malaysia: Direct-reduced iron	710	990	1,090	1,049 t/	1,050 e/
Mali	--	--	(9/)	--	-- e/
Mexico:					
Pig iron	3,423	3,500	4,142	4,229 t/	4,450
Direct-reduced iron	2,730	3,240	3,691	3,794 t/	4,440
Morocco e/	15	15	15	15	15
Netherlands 8/	5,404	5,443	5,647	5,545 t/	5,804
New Zealand	653	563	631	650 e/	650 e/
Nigeria: Direct-reduced iron	39	40	20 t/	20 e/	--
Norway e/	73 6/	70	70	70	70
Pakistan e/	1,200	1,045 6/	1,100	1,500	1,400
Paraguay	81	90	103	103 t/	82

See footnotes at end of table.

TABLE 10--Continued
 PIG IRON AND DIRECT-REDUCED IRON: WORLD PRODUCTION, BY COUNTRY 1/ 2/ 3/ 4/

(Thousand metric tons)

Country 5/	1993	1994	1995	1996	1997
Peru:					
Pig iron	147	150	150 e/	150 e/	150 e/
Direct-reduced iron	--	20	3	20	120
Poland	6,298	7,082	7,373	6,581 r/	7,033
Portugal	398	415 e/	416	421 r/	431
Qatar: Direct-reduced iron	573	600	630	632 r/	570
Romania	3,189	3,496	4,203	4,025 r/	4,557
Russia:					
Pig iron	40,871	36,116	39,762	36,061	37,327
Direct-reduced iron	1,540	1,710	1,680	1,500	1,730
Saudi Arabia: Direct-reduced iron	2,015	2,111	2,129	2,296	2,110
Serbia and Montenegro	62	17	108 r/	535 r/	907
Slovakia	3,210	3,330	3,300	3,300 e/	3,072
South Africa:					
Pig iron	6,940	6,982	7,137	6,876	6,192
Direct-reduced iron	870	980 r/	950 r/	900 r/	1,090
Spain	5,394	5,447	5,108 r/	4,128 r/	3,926
Sweden	2,845	3,037	3,020	3,255 r/	3,060
Switzerland e/	110 6/	110	100	100	100
Taiwan	6,116	5,941	6,060 r/ e/	6,050 e/	8,870
Trinidad and Tobago: Direct-reduced iron	715 r/	947 r/	1,039 r/	954 r/	1,140
Tunisia	165	154	162	151 r/	152
Turkey	4,353	4,604	4,363 r/	6,404 r/	5,513
Ukraine	26,999	21,200	20,000	18,143	20,561
United Kingdom	11,534	11,943	12,238	12,830 r/	13,057
United States:					
Pig iron	48,200	49,400	50,900	49,400	49,600
Direct-reduced iron	440	480	460	450	510
Venezuela: Direct-reduced iron	4,432 r/	4,803 r/	5,099 r/	5,380 r/	5,258
Zimbabwe	211	100 e/	209	210 e/	216
Grand total	531,000	544,000 r/	564,000	561,000 r/	585,000
Of which:					
Pig iron	507,000	516,000	533,000	528,000 r/	551,000
Direct-reduced iron	23,500 r/	27,700 r/	31,100 r/	32,700 r/	34,700

e/ Estimated. r/ Revised.

1/ Production is pig iron unless otherwise specified.

2/ Direct-reduced iron is obtained from ore by reduction of oxides to metal without melting.

3/ Table excludes ferroalloy production except where otherwise noted. Table includes data available through August 3, 1998.

4/ World totals, U.S. data, and estimated data are rounded to three significant digits; may not add to totals shown.

5/ In addition to the countries listed, Vietnam has facilities to produce pig iron and may have produced limited quantities during 1993-97; but output is not reported, and available information is inadequate to make reliable estimates of output levels.

6/ Reported figure.

7/ Figures reported by State Statistical Bureau that the Chinese Government considers as official statistical data.

8/ Includes blast furnace ferroalloys.

9/ Less than 1/2 unit.

TABLE 11
RAW STEEL: WORLD PRODUCTION, BY COUNTRY 1/ 2/ 3/

(Thousand metric tons)

Country 4/	1993	1994	1995	1996	1997 e/
Albania e/	19	19	22	20	20
Algeria	865 e/	808	827	675 e/	427 5/
Angola e/	9	9	9	9	9
Argentina	2,886	3,314 r/	3,581 r/	3,650	3,750
Australia	7,853	8,424	8,447	8,295	8,769 5/
Austria	4,149	4,405	4,537	4,442 r/	5,196 5/
Azerbaijan	228	36	12	25 r/	25
Bangladesh e/ 6/	32 5/	34	36	37	36
Belarus	946	880	744	886 e/	1,220
Belgium	10,173	11,319	11,606	10,773 r/	10,738 5/
Benin e/	2	--	--	--	--
Bosnia and Herzegovina e/	115	100	115	115	115
Brazil 7/	25,207	25,747	25,076	25,076 r/	25,100
Bulgaria	1,941	2,491	2,728	2,457 r/	2,500
Burma	11	17	24	25 e/	25
Canada	14,300	13,897	14,415	14,735 r/	15,360 p/
Chile 7/	1,069 r/	1,040 r/	1,014 r/	1,030 r/ e/	1,050
China 8/	89,560	92,610	95,360 r/	101,241 r/	107,600 5/
Colombia	687	693	714	677	710 p/
Croatia	74	63	45	46 r/	69 5/
Cuba	91 r/	131	207	231	342 5/
Czech Republic	6,744	7,093	6,746	6,257 r/	6,495 5/
Denmark	603	723	654 e/	737 r/	787 5/
Dominican Republic	--	--	--	6 r/	64 5/
Ecuador	27 r/	32 r/	35 r/	35 r/ e/	35
Egypt	2,772	2,622	2,642	2,620 e/	2,630
El Salvador e/	37	40	10 5/	42 r/	45 p/
Finland	3,256	3,420	3,180 e/	3,301 r/	3,300
France	17,179	18,028	18,096	17,630	19,773 5/
Georgia	215	141	84 e/	85 r/	104 5/
Germany	37,625	40,847	42,051 e/	39,791 r/	45,005 5/
Greece	980	848	939	848 r/	1,016 5/
Guatemala e/	18 5/	-- r/	-- r/	-- r/	--
Hong Kong e/	350	350	350	350	350
Hungary	1,752	1,937	1,865	1,969 r/	1,829 5/
India	18,155	19,285	22,800 r/	23,753 r/	23,748 5/
Indonesia	1,948	3,220	3,500 e/	3,400 e/	3,450
Iran	3,672	4,498	4,696	5,415 e/	6,322 5/
Iraq e/	300	300	300	300	300
Ireland	326	316	310 e/	340 r/	337
Israel	120	180	200	200 e/	200
Italy	25,701	26,114	27,766	23,922 r/	25,537 5/
Jamaica	25 e/	-- r/	-- r/	-- r/	-- 5/
Japan	99,623	98,295	101,640	98,801	104,545 5/
Jordan e/	30 5/	30	30	30	30
Kazakstan	4,279	2,969	2,963	3,142	3,900
Kenya e/	20	20	20	20	20
Korea, North e/	8,100	8,100	8,100	8,100	8,100
Korea, Republic of	33,000	33,745	36,772	38,903	42,554 5/
Latvia	300	332	279 r/	293 r/	300
Libya	920	874	909 r/	863 e/	897 5/
Luxembourg	3,293	3,092	3,079	2,501	2,580 5/
Macedonia	137	85 r/	90 r/ e/	90 r/ e/	90
Malaysia	1,808	2,046	2,450	3,216 r/	3,200
Mauritania e/	7 5/	7	5	5	5
Mexico	9,189	10,260	12,147 r/	13,172 r/	14,254 5/
Moldova	604	453	299	199 r/	255
Morocco e/	7	7	7	5	5
Netherlands	6,001	6,174	6,409	6,325 e/	6,640 5/
New Zealand	853	766	842	808 r/	758 5/
Nigeria e/	150	58	36	20	--

See footnotes at end of table.

TABLE 11--Continued
RAW STEEL: WORLD PRODUCTION, BY COUNTRY 1/ 2/ 3/

(Thousand metric tons)

Country 4/	1993	1994	1995	1996	1997 e/
Norway	505	456	503 r/	511 r/	510
Pakistan	1,100 e/	344	409	416 r/	450
Paraguay	77 r/	87 r/	95 r/	95 e/	95
Peru	417	506	515 e/	510 e/	510
Philippines	623	473	500 e/	500 e/	500
Poland	9,937	11,113	11,890	10,433 r/	11,591 5/
Portugal	775	749	829 r/	871 r/	860
Qatar	620	572	614 r/	626 r/	616 5/
Romania	5,446	5,800	6,555	6,083 r/	6,674 5/
Russia	58,346	48,812	51,300	49,193	48,441 5/
Saudi Arabia	2,318	2,411	2,451	2,683 5/	2,539 5/
Serbia and Montenegro	183	137	180	679 r/	979 5/
Singapore e/	500	500	500	500	500
Slovakia	3,768	3,948	3,255	3,200	3,000
Slovenia	355	424	450 r/	407 r/ e/	400
South Africa	8,726	8,320 r/	8,511 r/	7,968 r/	7,600
Spain	12,646	13,574	13,937	12,036 r/	13,644 5/
Sri Lanka e/	30	30	30	30	30
Sweden	4,591	4,952	4,926	4,910 r/	5,147 5/
Switzerland e/	1,260 5/	800	1,000	1,000	1,000
Syria e/	70	70	70	70	70
Taiwan	12,038	11,590	11,605	12,650 r/	15,000
Thailand	972 r/	1,391 r/	2,134 r/	2,143 r/	2,100
Trinidad and Tobago	496 r/	631	738 r/	695	736 5/
Tunisia	183	184	201	187	195 5/
Turkey	11,838 r/	12,074	12,745	13,382 e/	12,000
Uganda e/	20 r/	10 r/	12 r/	12 r/	15
Ukraine	32,357	23,798	22,309	22,100 r/	25,600
United Kingdom	16,625	17,286	17,604	18,220	18,528 5/
United States	88,800	91,200	95,200	95,500 r/	98,500 5/
Uruguay	36 r/	36 r/	40 r/	40 e/	40
Uzbekistan	573	364	352	444 r/	360
Venezuela	3,392	3,524	3,568	3,941 r/	4,019 5/
Vietnam e/	270 5/	300	320	320 r/	330
Zimbabwe	221	187	210 e/	212 e/	210
Total	730,000	730,000	757,000 r/	755,000	795,000

e/ Estimated. p/ Preliminary. r/ Revised.

1/ World totals, U.S. data, and estimated data are rounded to three significant digits; may not add to totals shown.

2/ Steel formed in solid state after melting, suitable for further processing or sale; for some countries, includes material reported as "liquid steel," presumably measured in the molten state prior to cooling in any specific form.

3/ Table includes data available through August 3, 1998.

4/ In addition to the countries listed, Ghana and Mozambique are known to have steelmaking plants, but available information is inadequate to make reliable estimates of output levels.

5/ Reported figure.

6/ Data for year ending June 30 of that stated.

7/ Excludes castings.

8/ Figures reported by State Statistical Bureau that Chinese Government considers as official statistical data.