Coke

Attachment 1

Division	Group	Class	Description
Division 15			**Manufacture of leather and related products**
	151		Tanning and dressing of leather; manufacture of luggage, handbags, saddlery and harness; dressing and dyeing of fur
		1511	Tanning and dressing of leather; dressing and dyeing of fur
		1512	Manufacture of luggage, handbags and the like, saddlery and harness
	152	1520	Manufacture of footwear
Division 16			**Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials**
	161	1610	Sawmilling and planing of wood
	162		Manufacture of products of wood, cork, straw and plaiting materials
		1621	Manufacture of veneer sheets and wood-based panels
		1622	Manufacture of builders' carpentry and joinery
		1623	Manufacture of wooden containers
		1629	Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials
Division 17			**Manufacture of paper and paper products**
		1701	Manufacture of pulp, paper and paperboard
		1702	Manufacture of corrugated paper and paperboard and of containers of paper and paperboard
		1709	Manufacture of other articles of paper and paperboard
Division 18			**Printing and reproduction of recorded media**
	181		Printing and service activities related to printing
		1811	Printing
		1812	Service activities related to printing
	182	1820	Reproduction of recorded media
Division 19			**Manufacture of coke and refined petroleum products**
	191	1910	Manufacture of coke oven products
	192	1920	Manufacture of refined petroleum products
Division 20			**Manufacture of chemicals and chemical products**
	201		Manufacture of basic chemicals, fertilizers and nitrogen compounds, plastics and synthetic rubber in primary forms
		2011	Manufacture of basic chemicals
		2012	Manufacture of fertilizers and nitrogen compounds
		2013	Manufacture of plastics and synthetic rubber in primary forms
	202		Manufacture of other chemical products
		2021	Manufacture of pesticides and other agrochemical products
		2022	Manufacture of paints, varnishes and similar coatings, printing ink and mastics
		2023	Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations
		2029	Manufacture of other chemical products n.e.c.
	203	2030	Manufacture of man-made fibres
Division 21			**Manufacture of pharmaceuticals, medicinal chemical and botanical products**
	210	2100	Manufacture of pharmaceuticals, medicinal chemical and botanical products

Coking Coal

Division	Group	Class	Description
		0163	Post-harvest crop activities
		0164	Seed processing for propagation
	017	0170	Hunting, trapping and related service activities
Division 02			**Forestry and logging**
	021	0210	Silviculture and other forestry activities
	022	0220	Logging
	023	0230	Gathering of non-wood forest products
	024	0240	Support services to forestry
Division 03			**Fishing and aquaculture**
	031		Fishing
		0311	Marine fishing
		0312	Freshwater fishing
	032		Aquaculture
		0321	Marine aquaculture
		0322	Freshwater aquaculture

Section B
Mining and quarrying

Division	Group	Class	Description
Division 05			**Mining of coal and lignite**
	051	0510	Mining of hard coal
	052	0520	Mining of lignite
Division 06			**Extraction of crude petroleum and natural gas**
	061	0610	Extraction of crude petroleum
	062	0620	Extraction of natural gas
Division 07			**Mining of metal ores**
	071	0710	Mining of iron ores
	072		Mining of non-ferrous metal ores
		0721	Mining of uranium and thorium ores
		0729	Mining of other non-ferrous metal ores
Division 08			**Other mining and quarrying**
	081	0810	Quarrying of stone, sand and clay
	089		Mining and quarrying n.e.c.
		0891	Mining of chemical and fertilizer minerals
		0892	Extraction of peat
		0893	Extraction of salt
		0899	Other mining and quarrying n.e.c.
Division 09			**Mining support service activities**
	091	0910	Support activities for petroleum and natural gas extraction
	099	0990	Support activities for other mining and quarrying

HRC & galvanised steel

Division	Group	Class	Description
Division 22			**Manufacture of rubber and plastics products**
	221		Manufacture of rubber products
		2211	Manufacture of rubber tyres and tubes; retreading and rebuilding of rubber tyres
		2219	Manufacture of other rubber products
	222	2220	Manufacture of plastics products
Division 23			**Manufacture of other non-metallic mineral products**
	231	2310	Manufacture of glass and glass products
	239		Manufacture of non-metallic mineral products n.e.c.
		2391	Manufacture of refractory products
		2392	Manufacture of clay building materials
		2393	Manufacture of other porcelain and ceramic products
		2394	Manufacture of cement, lime and plaster
		2395	Manufacture of articles of concrete, cement and plaster
		2396	Cutting, shaping and finishing of stone
		2399	Manufacture of other non-metallic mineral products n.e.c.
Division 24			**Manufacture of basic metals**
	241	2410	Manufacture of basic iron and steel
	242	2420	Manufacture of basic precious and other non-ferrous metals
	243		Casting of metals
		2431	Casting of iron and steel
		2432	Casting of non-ferrous metals
Division 25			**Manufacture of fabricated metal products, except machinery and equipment**
	251		Manufacture of structural metal products, tanks, reservoirs and steam generators
		2511	Manufacture of structural metal products
		2512	Manufacture of tanks, reservoirs and containers of metal
		2513	Manufacture of steam generators, except central heating hot water boilers
	252	2520	Manufacture of weapons and ammunition
	259		Manufacture of other fabricated metal products; metalworking service activities
		2591	Forging, pressing, stamping and roll-forming of metal; powder metallurgy
		2592	Treatment and coating of metals; machining
		2593	Manufacture of cutlery, hand tools and general hardware
		2599	Manufacture of other fabricated metal products n.e.c.
Division 26			**Manufacture of computer, electronic and optical products**
	261	2610	Manufacture of electronic components and boards
	262	2620	Manufacture of computers and peripheral equipment
	263	2630	Manufacture of communication equipment
	264	2640	Manufacture of consumer electronics
	265		Manufacture of measuring, testing, navigating and control equipment; watches and clocks
		2651	Manufacture of measuring, testing, navigating and control equipment
		2652	Manufacture of watches and clocks
	266	2660	Manufacture of irradiation, electromedical and electrotherapeutic equipment

IRON ORE

Division	Group	Class	Description
		0163	Post-harvest crop activities
		0164	Seed processing for propagation
	017	0170	Hunting, trapping and related service activities
Division 02			**Forestry and logging**
	021	0210	Silviculture and other forestry activities
	022	0220	Logging
	023	0230	Gathering of non-wood forest products
	024	0240	Support services to forestry
Division 03			**Fishing and aquaculture**
	031		Fishing
		0311	Marine fishing
		0312	Freshwater fishing
	032		Aquaculture
		0321	Marine aquaculture
		0322	Freshwater aquaculture

Section B
Mining and quarrying

Division	Group	Class	Description
Division 05			**Mining of coal and lignite**
	051	0510	Mining of hard coal
	052	0520	Mining of lignite
Division 06			**Extraction of crude petroleum and natural gas**
	061	0610	Extraction of crude petroleum
	062	0620	Extraction of natural gas
Division 07			**Mining of metal ores**
	071	0710	Mining of iron ores
	072		Mining of non-ferrous metal ores
		0721	Mining of uranium and thorium ores
		0729	Mining of other non-ferrous metal ores
Division 08			**Other mining and quarrying**
	081	0810	Quarrying of stone, sand and clay
	089		Mining and quarrying n.e.c.
		0891	Mining of chemical and fertilizer minerals
		0892	Extraction of peat
		0893	Extraction of salt
		0899	Other mining and quarrying n.e.c.
Division 09			**Mining support service activities**
	091	0910	Support activities for petroleum and natural gas extraction
	099	0990	Support activities for other mining and quarrying

Scrap Steel.

Division	Group	Class	Description
Division 37			**Sewerage**
	370	3700	Sewerage
Division 38			**Waste collection, treatment and disposal activities; materials recovery**
	381		Waste collection
		3811	Collection of non-hazardous waste
		3812	Collection of hazardous waste
	382		Waste treatment and disposal
		3821	Treatment and disposal of non-hazardous waste
		3822	Treatment and disposal of hazardous waste
	383	3830	Materials recovery
Division 39			**Remediation activities and other waste management services**
	390	3900	Remediation activities and other waste management services

Section F
Construction

Division	Group	Class	Description
Division 41			**Construction of buildings**
	410	4100	Construction of buildings
Division 42			**Civil engineering**
	421	4210	Construction of roads and railways
	422	4220	Construction of utility projects
	429	4290	Construction of other civil engineering projects
Division 43			**Specialized construction activities**
	431		Demolition and site preparation
		4311	Demolition
		4312	Site preparation
	432		Electrical, plumbing and other construction installation activities
		4321	Electrical installation
		4322	Plumbing, heat and air-conditioning installation
		4329	Other construction installation
	433	4330	Building completion and finishing
	439	4390	Other specialized construction activities

Section G
Wholesale and retail trade; repair of motor vehicles and motorcycles

Division	Group	Class	Description
Division 45			**Wholesale and retail trade and repair of motor vehicles and motorcycles**
	451	4510	Sale of motor vehicles
	452	4520	Maintenance and repair of motor vehicles

Attachment 2

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搜索

中华人民共和国国家统计局 >> 统计标准

中华人民共和国国家统计局 >> 统计用产品分类目录

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Classification of products subject to statistic analysis

(Catergories)

统计用产品分类目录

06-Products from coal mining and preparation

08-Ferrous metal ores

25-Petroleum processing, coking, and nuclear fuel processing industry

32-Ferrous metal smelting, rolling and processing industry

43-Processed products made by waste resources and recovered waste and scrap materials

01-农业产品	34-金属制品	67-餐饮服务
02-林业产品	35-通用设备	68-银行服务
03-饲养动物及其产品	36-专用设备	69-证券服务
04-渔业产品	37-交通运输设备	70-保险服务
05-农、林、牧、渔服务	38-收费的生产服务及修理	71-其他金融服务
06-煤炭采选产品	39-电气机械及器材	72-房地产服务
07-石油和天然气开采产品	40-通信设备、计算机及其他电子设备	73-租赁服务
08-黑色金属矿	41-仪器仪表及文化、办公用机械	74-商务服务
09-有色金属矿	42-工艺品及其他制造产品	75-研究与试验发展服务
10-非金属矿	43-废弃资源和废旧材料回收加工品	76-专业技术服务
11-其他矿产品	44-电力和热力	77-科技交流和推广服务
13-农副食品，动、植物油制品	45-燃气	78-地质勘查服务
14-食品及加工盐	46-水	79-水利管理服务
15-饮料、酒及酒精	47-房屋和土木工程服务与产品	80-环境管理服务
16-烟草制品	48-建筑安装服务	81-公共设施管理服务
17-纺织产品	49-建筑装饰服务	82-居民服务
18-服装、鞋、帽	50-其他建筑服务	83-维修、清洁和其他服务
19-皮革、毛皮及其制品	51-铁路运输服务	84-教育服务
20-木材及木、竹、藤、棕、草制品	52-道路运输服务	85-卫生服务
21-家具及配件	53-城市公共交通服务	86-社会保障服务
22-纸及纸制品	54-水路运输服务	87-社会福利服务
23-印刷品、记录媒介复制品	55-航空运输服务	88-新闻出版服务
24-文教体育用品	56-管道运输服务	89-广播、电视、电影和音像服务
25-石油加工、炼焦及核燃料	57-装卸搬运和其他运输服务	90-文化艺术服务
26-化学原料及化学制品	58-仓储服务	91-体育服务
27-医药	59-邮政寄递服务	92-娱乐服务
28-化学纤维	60-电信和其他信息传输服务	93-公共管理服务
29-橡胶制品	61-计算机信息服务	94-民主党派、工商联、群众团体服务
30-塑料制品、半成品及辅料	62-软件服务	95-社会团体、基金会及宗教组织服务
31-非金属矿物制品	63-批发服务	96-基层群众自治组织服务
32-黑色金属冶炼及压延产品	65-零售服务	97-国际组织及使领馆服务
33-有色金属冶炼及压延产品	66-住宿服务	

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2501 原油加工量
2502 石油制品
2503 人造原油
2504 焦炭及其副产品
2505 核燃料
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中华人民共和国国家统计局
National Bureau of Statistics of China

Code	Product Name
0601	Raw coal

代码	产品名称
0601	原煤
0602	洗煤
0699	其他煤炭采选产品（低热值燃料）

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中华人民共和国国家统计局
National Bureau of Statistics of China

代码	产品名称
060101	无烟煤
060102	烟煤

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www.stats.gov.cn/tjbz/tjycpflml/2010/06/01/060102.html 搜索

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代码	产品名称
06010201	炼焦烟煤
06010202	一般烟煤

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代码	产品名称	说明
0601020101	焦煤	
0601020102	1/3焦煤	
0601020103	肥煤	
0601020104	气肥煤	
0601020105	气煤	
0601020106	瘦煤	
0601020107	贫瘦煤	
0601020199	其他炼焦烟煤	

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代码	产品名称
32081710	镀层板带按镀层金属分
32081711	镀锌板带
32081720	镀层板带按规格分
32081721	镀层板带，宽度≥600mm
32081722	镀层板带，宽度<600mm
32081730	镀层板带按用途分
32081732	轻工家电用镀锌板带
32081735	包装用镀锡板带
32081740	镀层板带按化学成分分
32081741	非合金钢镀层板带
32081742	低合金钢镀层板带
32081743	合金钢镀层板带
32081744	不锈钢镀层板带
32081750	镀层板带按形状分

Code	Product Name
32081711	Galvanized Steel plates and strips

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中华人民共和国国家统计局
National Bureau of Statistics of China

代码	产品名称
320801	铁道用钢材
320802	大型型钢
320803	中小型型钢
320804	棒材
320805	钢筋
320806	线材（盘条）
320807	特厚板
320808	厚钢板
320809	中板
320810	热轧薄板
320811	冷轧薄板
320812	中厚宽钢带
320813	热轧薄宽钢带
320814	冷轧薄宽钢带
320815	热轧窄钢带
320816	冷轧窄钢带
320817	镀层板带
320818	涂层板带
320819	电工钢板带
320820	无缝钢管
320821	焊接钢管
320899	其他钢材

Code	Product Name
320810	Hot-rolled sheet
320813	Hot-rolled thin and wide steel strip
320815	Hot-rolled narrow steel strip
320817	Coated steel plates and strips

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National Bureau of Statistics of China

Code	Product Name
0801	Iron ore

代码	产品名称
0801	铁矿石
0802	锰矿
0803	铬矿石

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Code	Product Name
4301	Scrap metal and metal debris

代码	产品名称
4301	金属废料和碎屑
4302	非金属废料和碎屑

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www.stats.gov.cn/tjbz/tjycpflml/2010/43/4301.html

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代码	产品名称
430101	熔炼用废钢
430102	熔炼用废铁
430103	金属和金属化合物矿灰及残渣
430104	有色金属废料与碎屑
430105	贵金属或包贵金属废碎料
430106	废电池

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		2433	漆器工艺品制造	指将半生漆、腰果漆加工调配成各种鲜艳的漆料，以木、纸、塑料、铜、布等作胎，采用推光、雕填、彩画、镶嵌、刻灰等传统工艺和现代漆器工艺进行的工艺制品的制作活动
		2434	花画工艺品制造	指以绢、丝、绒、纸、涤纶、塑料、羽毛、通草以及鲜花草等为原料，经造型设计、模压、剪贴、干燥等工艺精制而成的花、果、叶等人造花类工艺品，以画面出现、可以挂或摆的具有欣赏性、装饰性的画类工艺品的制作活动
		2435	天然植物纤维编织工艺品制造	指以竹、藤、棕、草、柳、葵、麻等天然植物纤维为材料，经编织或镶嵌而成具有造型艺术或图案花纹，以欣赏为主的工艺陈列品以及工艺实用品的制作活动
		2436	抽纱刺绣工艺品制造	指以棉、麻、丝、毛及人造纤维纺织品等为主要原料，经设计、刺绣、抽、拉、钩等工艺加工各种生活装饰用品，以及以纺织品为主要原料，经特殊手工工艺或民间工艺方法加工成各种具有较强装饰效果的生活用纺织品的制作活动
		2437	地毯、挂毯制造	指以羊毛、丝、棉、麻及人造纤维等为原料，经手工编织、机织、栽绒等方式加工而成的各种具有装饰性的地面覆盖物或可用于悬挂、垫坐等用途的生活装饰用品的制作活动
		2438	珠宝首饰及有关物品制造	指以金、银、铂等贵金属及其合金以及钻石、宝石、玉石、翡翠、珍珠等为原料，经金属加工和连结组合、镶嵌等工艺加工制作各种图案的装饰品的制作活动
		2439	其他工艺美术品制造	
	244		体育用品制造	
		2441	球类制造	指各种皮制、胶制、革制的可充气的运动用球，以及其他材料制成的各种运动用硬球、软球等球类产品的生产活动
		2442	体育器材及配件制造	指各项竞技比赛和训练用器材及用品，体育场馆设施及器件的生产活动
		2443	训练健身器材制造	指供健身房、家庭或体育训练用的健身器材及运动物品的制造
		2444	运动防护用具制造	指用各种材质，为各项运动特制手套、鞋、帽和护具的生产活动
		2449	其他体育用品制造	指钓鱼专用的各种用具及用品，以及上述未列明的体育用品制造
	245	2450	玩具制造	指以儿童为主要使用者，用于玩耍、智力开发等娱乐器具的制造
	246		游艺器材及娱乐用品制造	
		2461	露天游乐场所游乐设备制造	指主要安装在公园、游乐园、水上乐园、儿童乐园等露天游乐场所的电动及非电动游乐设备和游艺器材的制造
		2462	游艺用品及室内游艺器材制造	指主要供室内、桌上等游艺及娱乐场所使用的游乐设备、游艺器材和游艺娱乐用品，以及主要安装在室内游乐场所的电子游乐设备的制造
		2469	其他娱乐用品制造	
25			**石油加工、炼焦和核燃料加工业**	25 Petroleum processing, coking, and nuclear fuel processing industry
	251		精炼石油产品制造	
		2511	原油加工及石油制品制造	指从天然原油、人造原油中提炼液态或气态燃料以及石油制品的生产活动
		2512	人造原油制造	指从油母页岩中提炼原油的生产活动
	252	2520	炼焦	指主要从硬煤和褐煤中生产焦炭、干馏炭及煤焦油或沥青等副产品的炼焦炉的操作活动

2520 Coking

		3052	光学玻璃制造	指用于放大镜、显微镜、光学仪器等方面的光学玻璃，日用光学玻璃，钟表用玻璃或类似玻璃，光学玻璃眼镜毛坯的制造，以及未进行光学加工的光学玻璃元件的制造
		3053	玻璃仪器制造	指实验室、医疗卫生用各种玻璃仪器和玻璃器皿以及玻璃管的制造
		3054	日用玻璃制品制造	指餐厅、厨房、卫生间、室内装饰及其它生活用玻璃制品的制造
		3055	玻璃包装容器制造	指主要用于产品包装的各种玻璃容器的制造
		3056	玻璃保温容器制造	指玻璃保温瓶和其他个人或家庭用玻璃保温容器的制造
		3057	制镜及类似品加工	指以平板玻璃为材料，经对其进行镀银、镀铝，或冷、热加工后成型的镜子及类似制品的制造
		3059	其他玻璃制品制造	
	306		玻璃纤维和玻璃纤维增强塑料制品制造	
		3061	玻璃纤维及制品制造	
		3062	玻璃纤维增强塑料制品制造	也称玻璃钢，指用玻璃纤维增强热固性树脂生产塑料制品的活动
	307		陶瓷制品制造	
		3071	卫生陶瓷制品制造	指卫生和清洁盥洗用的陶瓷用具的生产活动
		3072	特种陶瓷制品制造	指专为工业、农业、实验室等领域的各种特定用途和要求，采用特殊生产工艺制造陶瓷制品的生产活动
		3073	日用陶瓷制品制造	指以粘土、瓷石、长石、石英等为原料，经破碎、制泥、成型、烧炼等工艺制成，主要供日常生活用的各种瓷器、炻器、陶器等陶瓷制品的制造
		3079	园林、陈设艺术及其他陶瓷制品制造	指以石英、长石、瓷土等为原料，经制胎、施釉、装饰、烧成等工艺制成的，具有艺术造型或花纹、图案等，主要供陈设、观赏或装饰用的纯艺术欣赏陶瓷制品和以欣赏为主的陶瓷陈列品、实用品的制造，以及其他未列明的陶瓷制品的制造
	308		耐火材料制品制造	
		3081	石棉制品制造	指以石棉或其他矿物纤维素为基础，制造摩擦制品、石棉纺织制品、石棉橡胶制品、石棉保温隔热材料制品的生产活动
		3082	云母制品制造	
		3089	耐火陶瓷制品及其他耐火材料制造	指用硅质、粘土质、高铝质等石粉成形的陶瓷隔热制品的制造
	309		石墨及其他非金属矿物制品制造	
		3091	石墨及碳素制品制造	指以炭、石墨材料加工的特种石墨制品、碳素制品、异形制品，以及用树脂和各种有机物浸渍加工而成的碳素异形产品的制造
		3099	其他非金属矿物制品制造	
31			**黑色金属冶炼和压延加工业**	
	311	3110	炼铁	指用高炉法、直接还原法、熔融还原法等，将铁从矿石等含铁化合物中还原出来的生产活动
	312	3120	炼钢	指利用不同来源的氧（如空气、氧气）来氧化炉料（主要是生铁）所含杂质的金属提纯活动
	313	3130	黑色金属铸造	指铸铁件、铸钢件等各种成品、半成品的制造
	314	3140	钢压延加工	指通过热轧、冷加工、锻压和挤压等塑性加工使连铸坯、钢锭产生塑性变形，制成具有一定形状尺寸的钢材产品的生产活动

31 Ferrous metal smelting, rolling and processing industry

3140 Steel rolling and processing

B Mining

06 Coal mining and preparation industry

0610 Bituminous coal and anthracite mining and preparation industry

B				**采矿业**	本类包括06～12大类，采矿业指对固体（如煤和矿物）、液体（如原油）或气体（如天然气）等自然产生的矿物的采掘；包括地下或地上采掘、矿井的运行，以及一般在矿址或矿址附近从事的旨在加工原材料的所有辅助性工作，例如碾磨、选矿和处理，均属本类活动；还包括使原料得以销售所需的准备工作；不包括水的蓄集、净化和分配，以及地质勘查、建筑工程活动
	06			**煤炭开采和洗选业**	指对各种煤炭的开采、洗选、分级等生产活动；不包括煤制品的生产和煤炭勘探活动
		061	0610	烟煤和无烟煤开采洗选	指对地下或露天烟煤、无烟煤的开采，以及对采出的烟煤、无烟煤及其他硬煤进行洗选、分级等提高质量的活动
		062	0620	褐煤开采洗选	指对褐煤——煤化程度较低的一种燃料的地下或露天开采，以及对采出的褐煤进行洗选、分级等提高质量的活动
		069	0690	其他煤炭采选	指对生长在古生代地层中的含碳量低、灰分高的煤炭资源（如石煤、泥炭）的开采
	07			**石油和天然气开采业**	指在陆地或海洋，对天然原油、液态或气态天然气的开采，对煤矿瓦斯气（煤层气）的开采；为运输目的所进行的天然气液化和从天然气田气体中生产液化烃的活动，还包括对含沥青的页岩或油母页岩矿的开采，以及对焦油沙矿进行的同类作业
		071	0710	石油开采	
		072	0720	天然气开采	
	08			**黑色金属矿采选业**	
		081	0810	铁矿采选	指对铁矿石的采矿、选矿活动
		082	0820	锰矿、铬矿采选	
		089	0890	其他黑色金属矿采选	指对钒矿等钢铁工业黑色金属辅助原料矿的采矿、选矿活动
	09			**有色金属矿采选业**	指对常用有色金属矿、贵金属矿，以及稀有稀土金属矿的开采、选矿活动
		091		常用有色金属矿采选	指对铜、铅锌、镍钴、锡、锑、铝、镁、汞、镉、铋等常用有色金属矿的采选
			0911	铜矿采选	
			0912	铅锌矿采选	
			0913	镍钴矿采选	
			0914	锡矿采选	
			0915	锑矿采选	
			0916	铝矿采选	
			0917	镁矿采选	
			0919	其他常用有色金属矿采选	
		092		贵金属矿采选	指对在地壳中含量极少的金、银和铂族元素（铂、铱、锇、钌、钯、铑）矿的采选
			0921	金矿采选	
			0922	银矿采选	
			0929	其他贵金属矿采选	
		093		稀有稀土金属矿采选	指对在自然界中含量较小，分布稀散或难以从原料中提取，以及研究和使用较晚的金属矿开采、精选
			0931	钨钼矿采选	
			0932	稀土金属矿采选	指镧系金属及与镧系金属性质相近的金属矿的采选

08 Ferrous metal mining and dressing industry

0810 Iron ore mining and dressing

41			**其他制造业**	
	411		日用杂品制造	
		4111	鬃毛加工、制刷及清扫工具制造	指用原毛加工成生产刷子类产品的成品毛的生产，或以成品毛和棕、金属丝、塑料丝等为原料加工制刷的生产，以及其他清扫工具的制造
		4119	其他日用杂品制造	指制伞及其他未列明的各种日常生活用杂品的生产活动
	412	4120	煤制品制造	指用烟煤、无烟煤、褐煤及其他各种煤炭制成的煤砖、煤球等固体燃料制品的活动
	413	4130	核辐射加工	指核技术与同位素技术的应用，由核辐照站利用核技术对原有产品改良、改变性质并使其增值的加工活动
	419	4190	其他未列明制造业	
42			**废弃资源综合利用业**	指废弃资源和废旧材料回收加工
	421	4210	金属废料和碎屑加工处理	指从各种废料［包括固体废料、废水（液）、废气等］中回收，并使之便于转化为新的原材料，或适于进一步加工为金属原料的金属废料和碎屑的再加工处理活动，包括废旧电器、电子产品拆解回收
	422	4220	非金属废料和碎屑加工处理	指从各种废料［包括固体废料、废水（液）、废气等］中回收，或经过分类，使其适于进一步加工为新原料的非金属废料和碎屑的再加工处理活动

42 Comprehensive utilization of waste resources industry

4210 Scrap metal and metal debris processing

43			**金属制品、机械和设备修理业**	
	431	4310	金属制品修理	
	432	4320	通用设备修理	
	433	4330	专用设备修理	
	434		铁路、船舶、航空航天等运输设备修理	
		4341	铁路运输设备修理	不包括火车机车回厂修理和发动机修理活动
		4342	船舶修理	不包括船舶回厂修复、发动机修理以及船舶拆除活动
		4343	航空航天器修理	不包括航空航天器回厂修理和发动机修理活动
		4349	其他运输设备修理	
	435	4350	电气设备修理	
	436	4360	仪器仪表修理	
	439	4390	其他机械和设备修理业	

Attachment 4 - CNEI v ISIC product classifications

Product	Classification Code of National Economy Industry & Industry Name		ISIC Code and Industry Name	
Coke	**25**	**Petroleum processing, coking, and nuclear fuel processing industry**		
	2520	Coking	1910	Manufacture of coke oven products
Coking Coal	**06**	**Coal mining and preparation industry**		
	0610	Bituminous coal and anthracite mining and preparation industry	0510	Mining of hard coal
Iron Ore	**08**	**Ferrous metal mining and dressing industry**		
	0810	Iron ore mining and dressing	0710	Mining of iron ores
Steel Scrap	**42**	**Comprehensive utilization of waste resources industry**		
	4210	Scrap metal and metal debris processing	3830	Materials recovery
			3821	Treatment and disposal of non-hazardous waste
			3822	Treatment and disposal of hazardous waste
Hot-rolled Coils, galvanised Steel/Aluminium Zinc Coated Steel	**31**	**Ferrous metal smelting, rolling and processing industry**		
	3140	Steel rolling and processing	2410	Manufacture of basic iron and steel

Attachment 5

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日照钢铁有限公司水冷箱及卷筒招标通知
日照钢铁有限公司非标件及加热炉备件招标通知
日照钢铁有限公司刀具及非标件招标通知
日照钢铁有限公司仪表阀门及液力偶合器招标通知
日照钢铁有限公司输送带招标通知
日照钢铁有限公司保卫部用品招标通知
日照钢铁有限公司毛巾招标通知
日照旭日发电有限公司节水改造工程项目海洋环境影响评价第一次公示
日照钢铁有限公司合金需求信息通知
日照钢铁有限公司煤炭开户标准和原则

简体中文 English

Date: December 9, 2011

热轧卷板产品系列

Category of Hot-rolled coils

发布时间：2011-12-9　发布人：管理员　浏览次数：10814次

[H型钢产品系列](#)
[工字钢产品系列](#)
[槽钢产品系列](#)
[棒材产品系列](#)
[高速线材产品系列](#)
[热轧卷板产品系列](#)
[钢板坯产品系列](#)
[焊管产品系列](#)
[开平钢板](#)
[水泥](#)
[双掺粉](#)
[高炉水淬渣](#)
[转炉钢渣粉](#)
[高炉矿渣粉](#)

Category　Series　Grade　Specification　Corresponding standard　Note　Contact Iformation

类别	系列	牌号	规格	对应标准	备注	联系方式
普通热卷	普通碳素结构钢	Q195 Q215 A-B Q235 A-D Q275 A-D	1.5-25.4×1000-1250 2.0-25.4×1000-2000	GB/T912 GB/T3274	可生产加B或加Cr合金钢	曹强: 0633-2969102
花纹板	花纹板	HQ235B	1.7～12.7*1010～1500	GB/T3277		
冷轧料料	优质碳素钢	SPHC	1.5～6.0×900～2000	JIS G3131 ASTM A568M		孟庆江： 0633-6187609
		SPHD				
		SAE1006 SAE1017				
焊管料	碳素结构钢	SS400	1.5~2.0×1000 2.0×1250/2.5~3.5×1500~2000	JIS G3101 EN10025 GB/T912 GB/T3274 ASTMA283/ A283M ASTM A36/ A36A		谈志云: 0633-6181683
		S235～ S355JR-J2				
		Q195~Q275B-D				
		A283C				
		A36				
	石油管线钢	X42	5.0~10.0×1000~2000	API SPEC. 5L GB/T14164 GB/T9711.1	重点方向为高强度厚规格	
		X52				
		X56	10.0~20.0×1000~2000			
		X60				
		X65	5.0~10.0×1000~2000 10.0~20.0×1000~2000			
结构钢						王元宝:

Normal hot-rolled coils
-Plain carbon structural steel

checkered plate
-checkered plate

Materials for cold-rolled products
-High-quality carbon structural steel

Materials for Welded pipes
-Carbon structural steel

-Materials for petroleum pipe lines

Constructional steel

-Petroleum casing pipe steel

High-strength low-alloy/
microalloyed steels：

-Building structural steel

High-strength low-alloy/
microalloyed steels :

-Automobile wheel steel

-Automobile beam steel

	石油套管钢	H40	5.0~12.7×1070	API SPEC 5CT SY/T 6194	重点开发 倍尺料	0633-6188316
			5.0~12.7×1000~1600			
		J55	5.0~12.7×1070			
			5.0~12.7×1000~1600			
		N80	5.0~12.7×1070			
			5.0~12.7×1000~1600			
低/微合金钢高强度	建筑结构用钢	Q295B	3.0~20.0×1250~2000	GB/T912 GB/T3274	重点开发 高强度厚规格 低温断裂韧性	曲春超: 0633-6188008
		Q345B				
		Q345C~D				
		Q345E				
		Q390B				
		Q390 C~E				
		Q420B				
		Q420 C~E				
		Q460C~D				
		Q460E				
		SM490		JIS G3106		
低/微合金钢高强度	汽车车轮钢	330CL	2.3~20.0×1250~2000	YB/T4151		贾志鑫: 0633-6182599
		380CL				
		440CL				
		540～590CL				
	汽车大梁钢	510L	2.3~20.0×1250~2000	GB/T3273		
		610L				
			1.6~3.0×1000~1200			郭浩章:

Corrosion-resisting steel：

-Container steel

-Steel for railway vehicles

Ship plate steel：

- Normal strength
- High strength

耐蚀钢	集装箱用钢	SPA-H	3.0~6.0×1000~1500	JIS G3125	重点薄规格 高强度	0633-6188278
	铁道车辆用钢	09CuPCrNi	1.6~3.0×1000~1200	GB/T 4171		郭浩章：0633-6188278
			3.0~6.0×1000~1500			
船板钢	一般强度级	A、B、D	厚度≤25.0mm 宽度≤2000mm	船级社规范GB/T712	九国船级社认证	王元宝：0633-6188316
	高强度级	A~D32~36				

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钢铁业一流资讯商务平台
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China Steel Industry to Keep Stable Growth in Next Five Years

Wu Wenzhang
President
Shanghai SteelHome Website

India, March 2011

上海钢之家信息科技有限公司
http://www.steelhome.cn

Key Points

1.Stable and relatively fast growing economy has proved to be the primary impetus behind China steel industry over the past decade. China steel industry is mainly based on domestic demand and its development has become the main driving force of global steel industry.

2.The rapid growth in China steel industry has contributed to global raw materials market boom. China and global steel industry is seriously damaged by top three iron ore giants because they changed pricing system and pushed up iron ore prices.

3.As Chinese government is accelerating the transformation of economic growth, actively promoting economic restructuring and striving to boost household consumption, crude steel consumption intensity per unit of GDP will decrease year by year. However, unbalanced development in different regions in China will sustain crude steel consumption at high level.

Key Points

4.China steel industry is now working on energy saving& emission cut and product mix adjustment, so capacity additions will grow slowly.

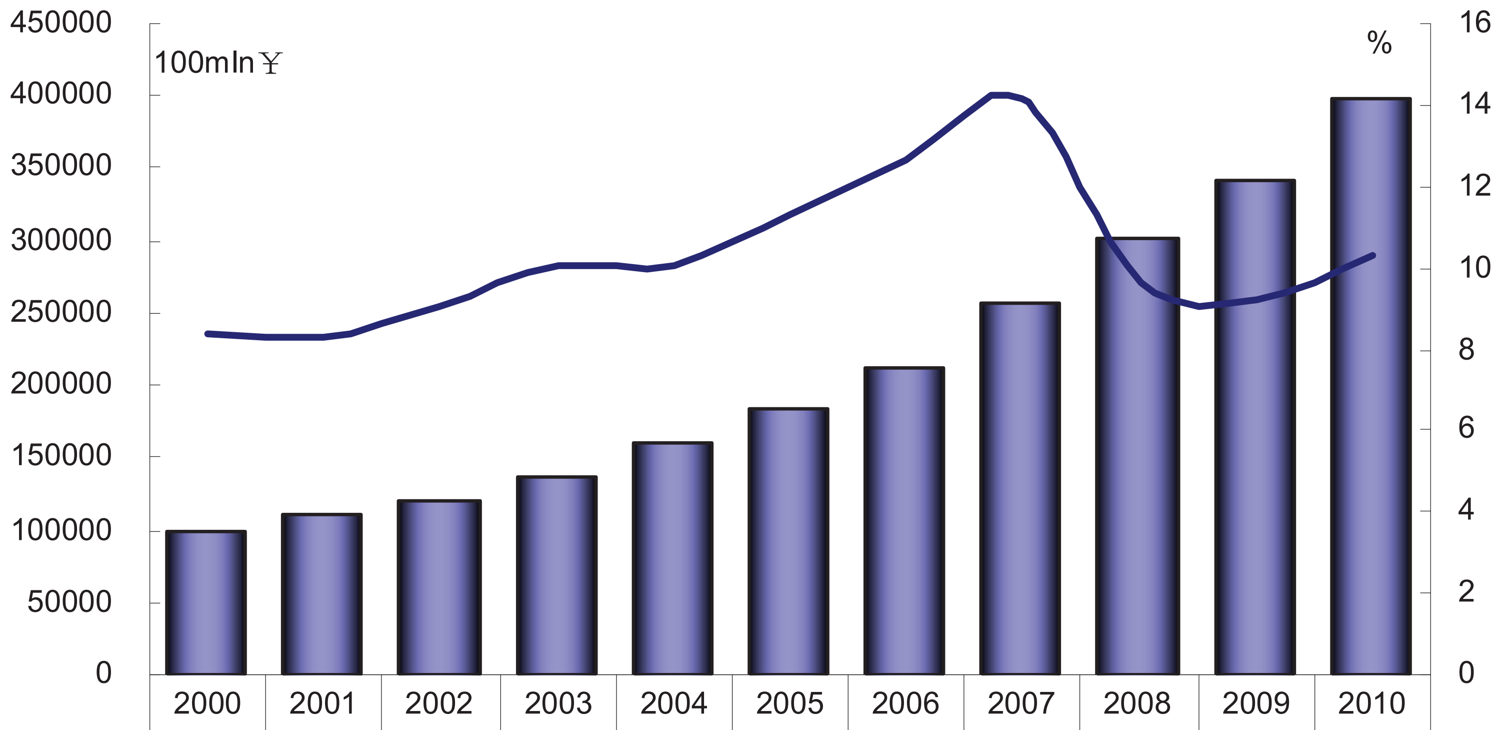
5.China's crude steel production and consumption will peak in 2012. We expect that China crude steel consumption will show downward trend after 2015 and might decrease to 600 million tonnes or even less by 2020. China steel imports and exports will maintain at a reasonable level and production will depend on global demand.

6.China's dependency on iron ore imports will gradually decrease since a) domestic iron ore capacity will further increase in the next five years as steel mills intensify domestic mining b) Chinese steel mills actively promote overseas mining projects to enhance resources supply capacity. c) China's reservoir of obsolete scrap will increase on rising cumulative steel consumption.

7.The pace of M&As in China steel industry is accelerating and concentration rate is increasing.

8 China 2011 steel market will see slowing production rise, basic balance of supply and demand, reasonable level of inventory, and higher price level than 2010.

China GDP and Growth in 2000-2010

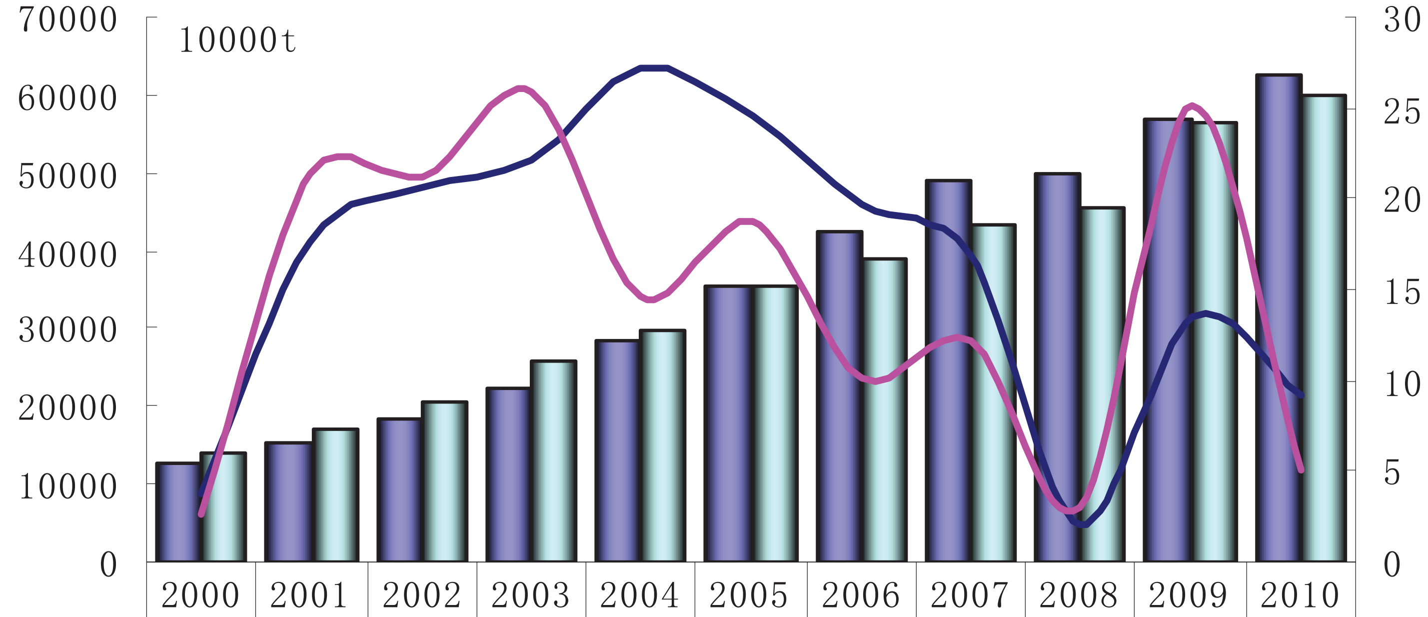


	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
GDP	99215	109655	120333	135823	159878	183868	210871	257306	300670	340903	397983
growth%	8.4	8.3	9.1	10.0	10.1	11.3	12.7	14.2	9.6	9.2	10.3

Data: NBS, SteelHome

In 2010, China GDP totaled CNY 39.8 trillion, four folds over 2000.

China Crude Steel Production & Apparent Consumption in 2000-2010



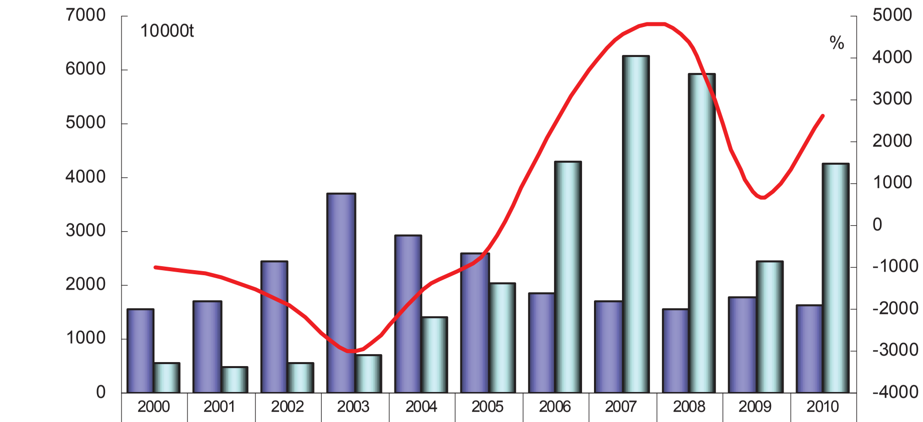
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Product	12850	15103	18225	22241	28291	35239	42266	48966	50092	56784	62665
ASC.	13977	16977	20577	25896	29675	35227	38793	43477	45328	56500	59936
P. growth%	3.7	17.5	20.7	22.0	27.2	24.6	19.7	16.8	2.1	13.5	9.3
A. growth%	2.6	21.5	21.2	25.9	14.6	18.7	10.1	12.1	2.9	25.2	5.0

Data: NBS, China Customs, SteelHome

In 2010, China crude steel production hit 627 million tonnes, increasing 4.9 folds from 2000; apparent steel consumption was 600 million tonnes, 4.3 folds from 2000.

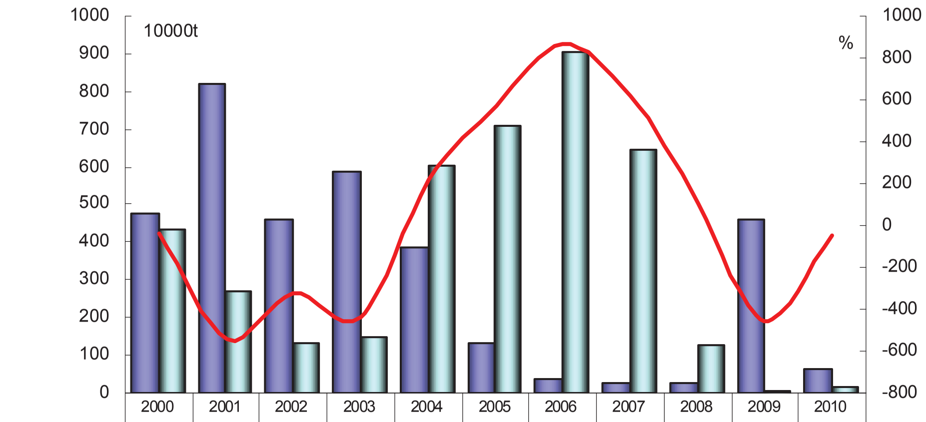
China Steel Industry Based on Domestic Demand

China: Steel Products Import/Export in 2000-2010



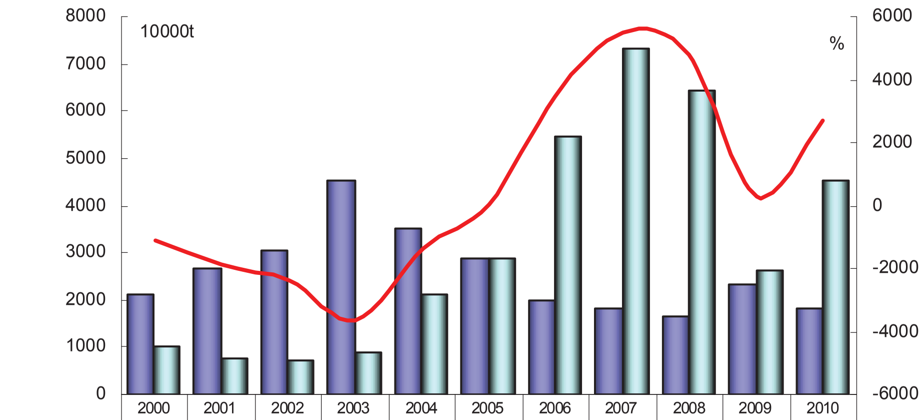
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Imp.	1561	1722	2449	3717	2930	2582	1851	1687	1539	1764	1643
Exp.	540	474	545	696	1423	2052	4301	6265	5918	2458	4256
Net Exp	-1021	-1248	-1903	-3021	-1507	-530	2450	4578	4380	694	2613

China: Semis Import/Export in 2000-2010



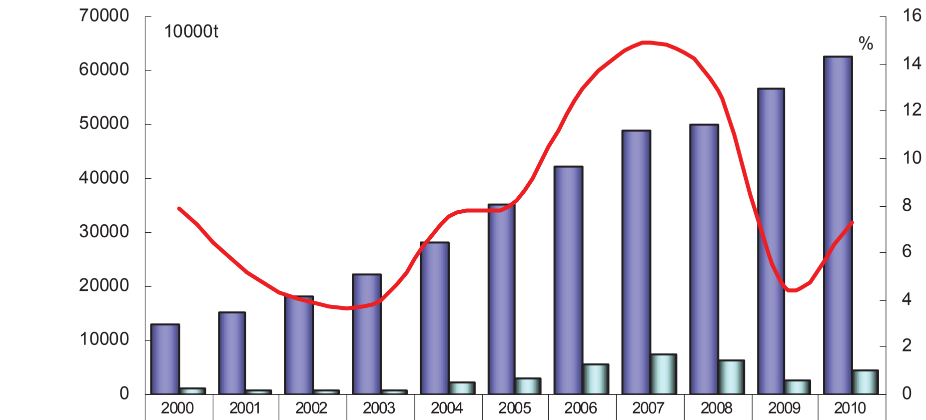
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Imp.	475	818	460	588	386	131	37	24	25	459	64
Exp.	434	271	133	147	606	707	904	643	129	4	14
Net Exp	-41	-547	-327	-441	220	575	867	619	104	-454	-50

China: Crude Steel Import/Export in 2000-2010



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Imp.	2136	2649	3066	4542	3503	2878	2006	1819	1661	2335	1812
Exp.	1009	775	714	887	2120	2890	5479	7308	6425	2619	4542
Net Exp	-1127	-1874	-2352	-3655	-1384	12	3473	5489	4763	284	2730

China: Crude Steel Exports as a Share of Production in 2000-2010

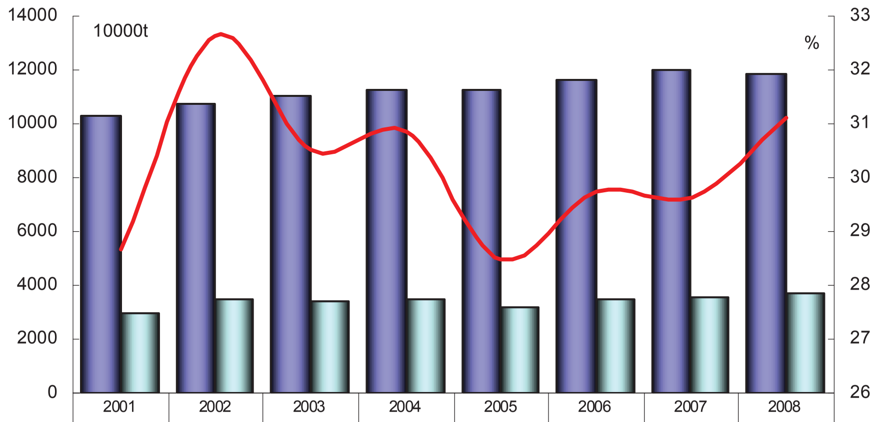


	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Production	12850	15103	18225	22241	28291	35239	42266	48966	50092	56784	62665
Exp.	1009	775	714	887	2120	2890	5479	7308	6425	2619	4542
Rate%	7.8	5.1	3.9	4.0	7.5	8.2	13.0	14.9	12.8	4.6	7.2

China crude steel exports take 7-15pct as a share of production since 2005. Source from NBS, Customs, SteelHome

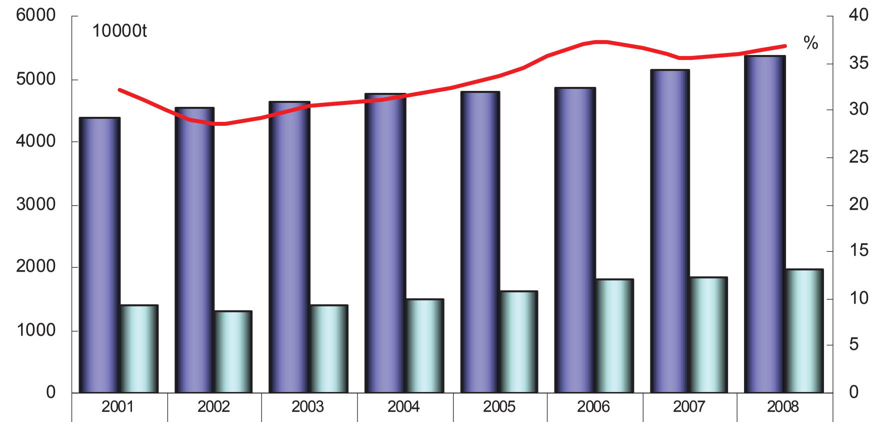
China Steel Industry Based on Domestic Demand

Japan: Ratio of Steel Export to Output in 2000-2008



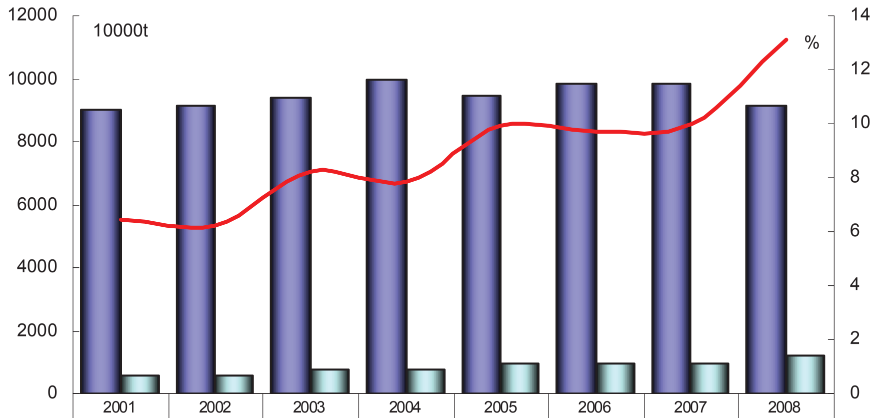
	2001	2002	2003	2004	2005	2006	2007	2008
Product	10287	10775	11051	11272	11247	11623	12020	11874
Export	2949	3516	3373	3477	3204	3456	3563	3692
Rate%	28.7	32.6	30.5	30.8	28.5	29.7	29.6	31.1

South Korea: Ratio of Steel Export to Output in 2000-2008



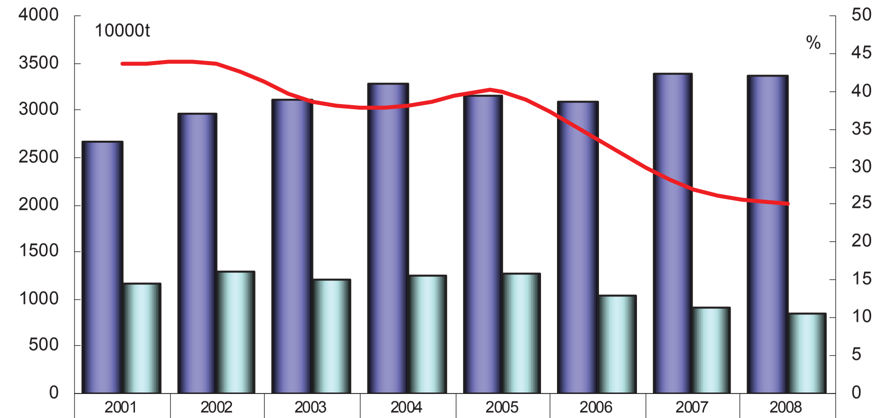
	2001	2002	2003	2004	2005	2006	2007	2008
Product	4385	4539	4631	4752	4782	4846	5152	5363
Export	1408	1295	1409	1502	1612	1802	1826	1972
Rate%	32.1	28.5	30.4	31.6	33.7	37.2	35.5	36.8

USA: Ratio of Steel Export to Output in 2000-2008



	2001	2002	2003	2004	2005	2006	2007	2008
Product	9010	9159	9368	9968	9490	9856	9810	9135
Export	582	567	773	781	941	957	980	1196
Rate%	6.5	6.2	8.2	7.8	9.9	9.7	10.0	13.1

Brazil: Ratio of Steel Export to Output in 2000-2008

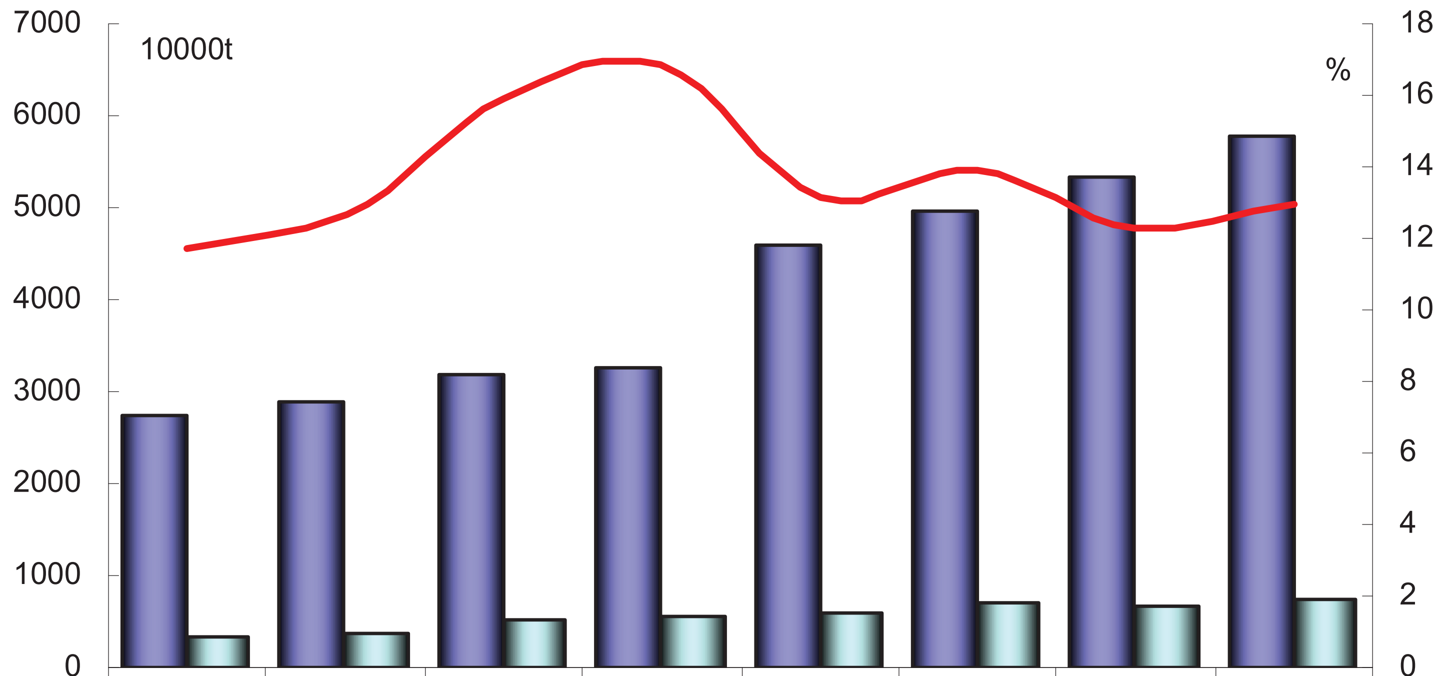


	2001	2002	2003	2004	2005	2006	2007	2008
Product	2672	2960	3115	3291	3161	3090	3378	3372
Export	1165	1294	1201	1254	1263	1041	915	850
Rate%	43.6	43.7	38.5	38.1	39.9	33.7	27.1	25.2

For major steel-making countries, ratio of steel export to production stands over 20 pct (like Japan, South Korea and Brazil) and even for USA, the ratio is around 10 pct.

Source: WSA

India: Ratio of Steel Export to Production in 2000-2008

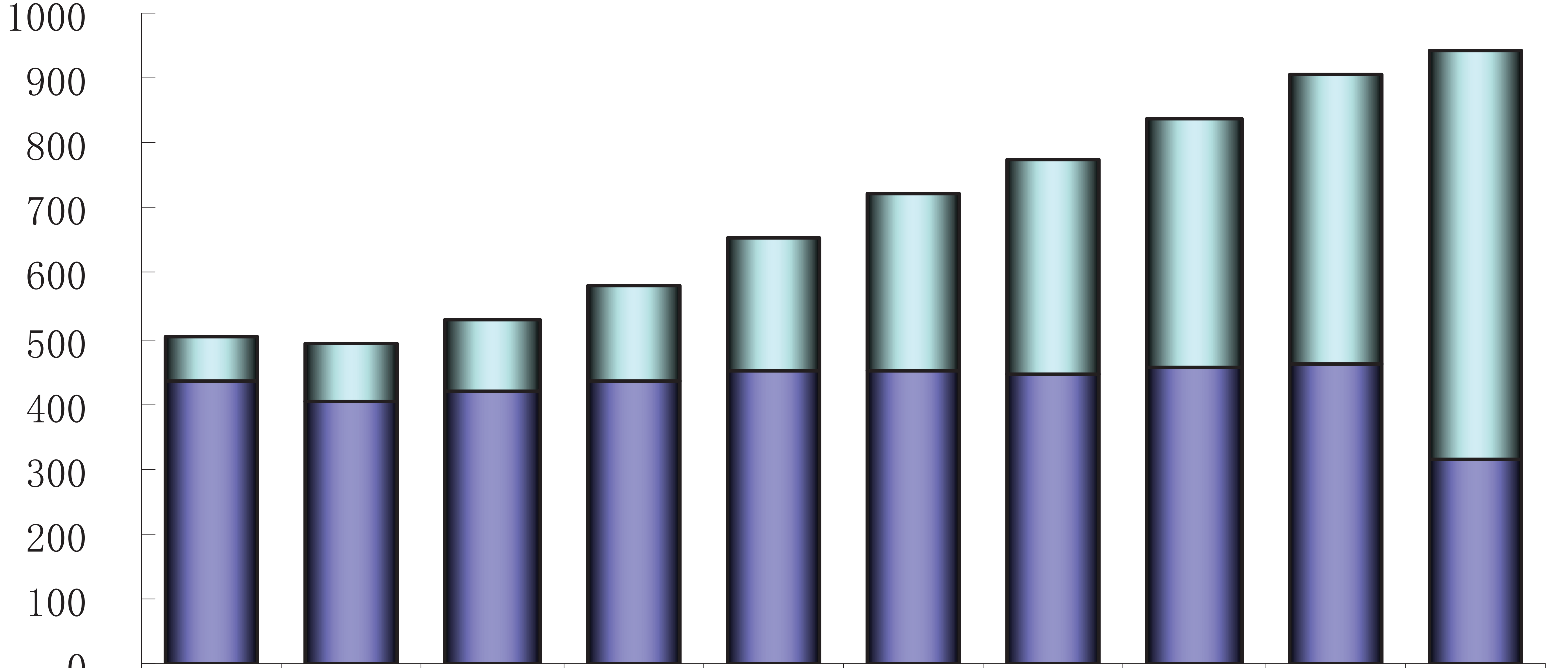


	2001	2002	2003	2004	2005	2006	2007	2008
Production	2729	2881	3178	3263	4578	4945	5347	5779
Export	319	364	507	549	600	687	659	749
Rate%	11.7	12.6	16.0	16.8	13.1	13.9	12.3	13.0

Source from WSA

China's ratio of steel export to production was lower than India, but 2007 was an exception.

World Iron Ore Exports in 2000-2009

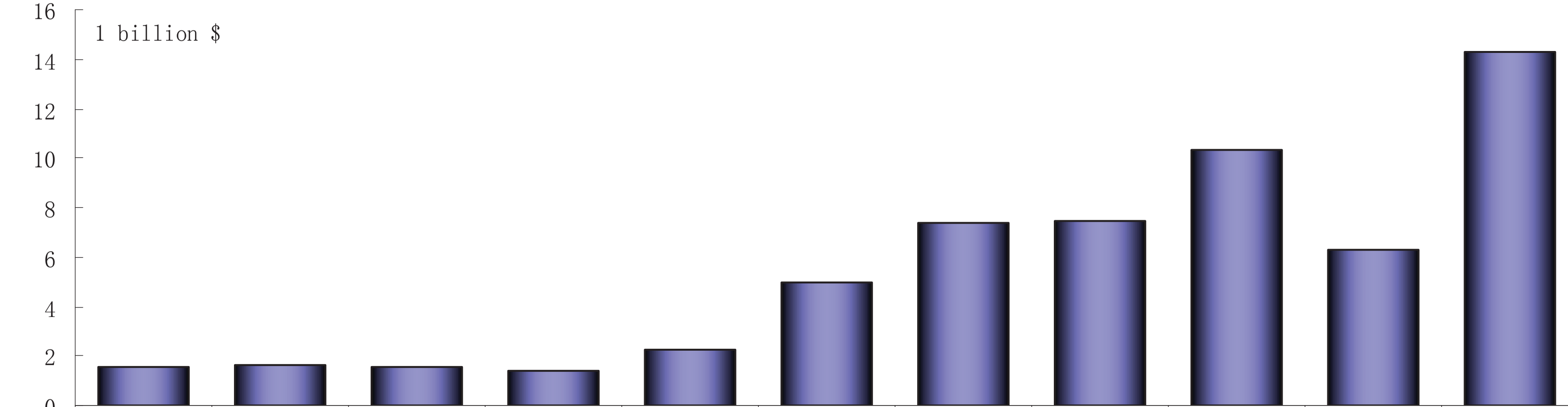


	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
China	70	92	112	148	208	275	326	383	444	628
ROW	432	401	416	432	449	449	446	454	460	313

Source from WSA

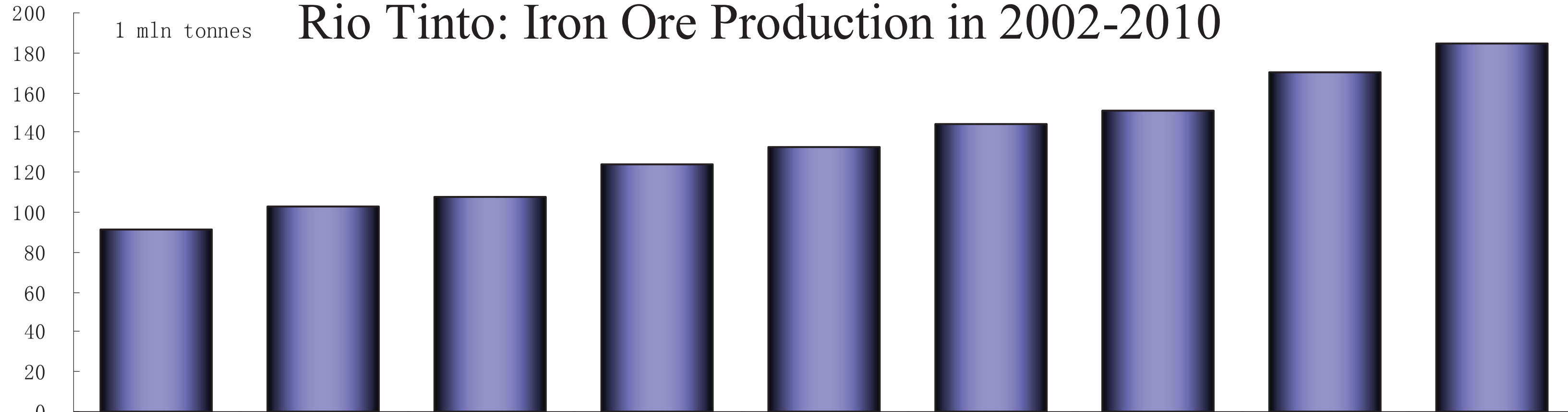
Additions in global iron ore trade are basically consumed by China. Global iron ore trade volume hit 941 million tonnes in 2009, up 439 million tonnes over 2000. China imported 628 million tonnes of iron ore in 2009, up 558 million tonnes over 2000.

Rio Tinto: Underlying Earnings in 2000-2010



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
billion$	1.52	1.66	1.55	1.4	2.27	4.96	7.34	7.44	10.3	6.3	14.3

Rio Tinto: Iron Ore Production in 2002-2010

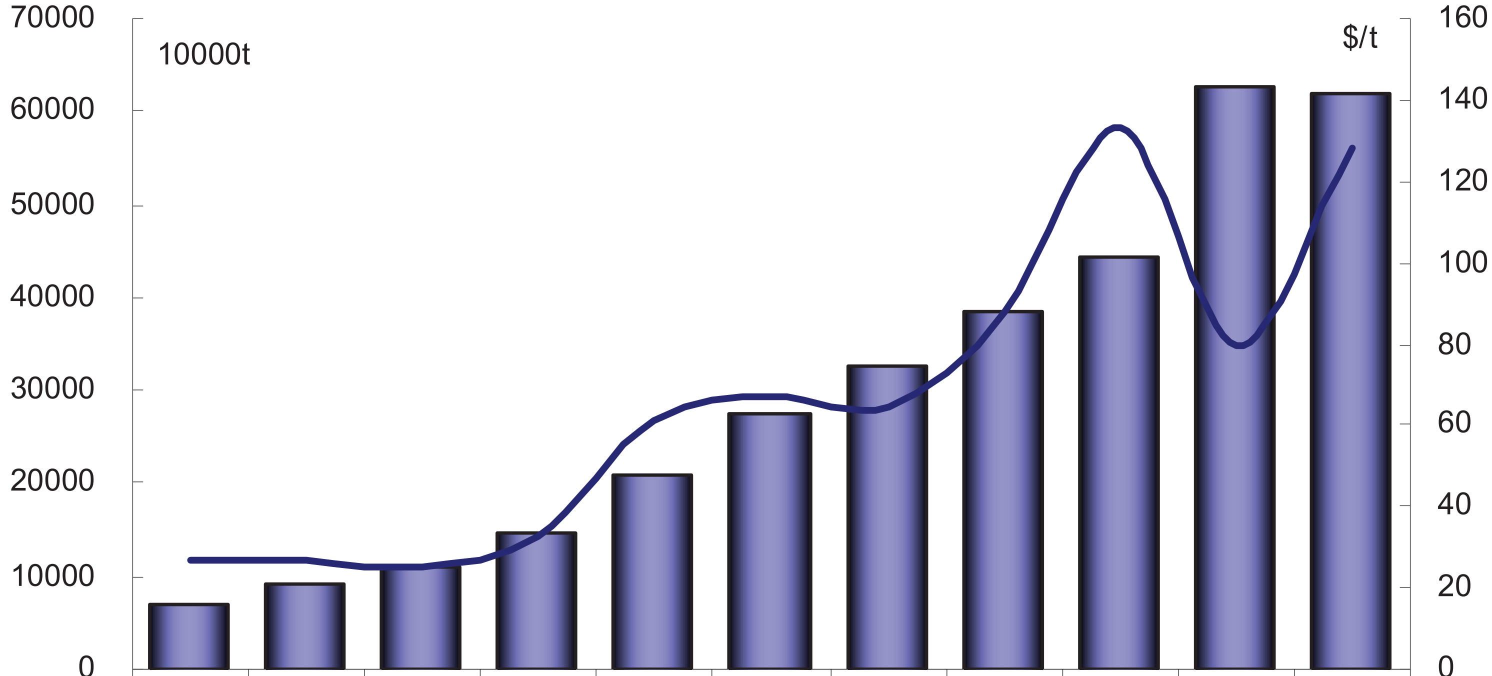


	2002	2003	2004	2005	2006	2007	2008	2009	2010
iron ore	90.95	102.61	107.76	124.49	132.78	144.71	151.36	170.04	184.60

Source: Riotinto

Long term contract collapsed in 2010. World's leading iron ore giants adopt quarterly or index pricing and their profits surge massively. Taking Rio Tinto as an example, iron ore production gained 27.5 percent from 2007 to 184.6 million tonnes in 2010, and profits surged 92.2pct to US$ 14.3billion.

China: Average Price of Import Iron Ore during 2000-2010

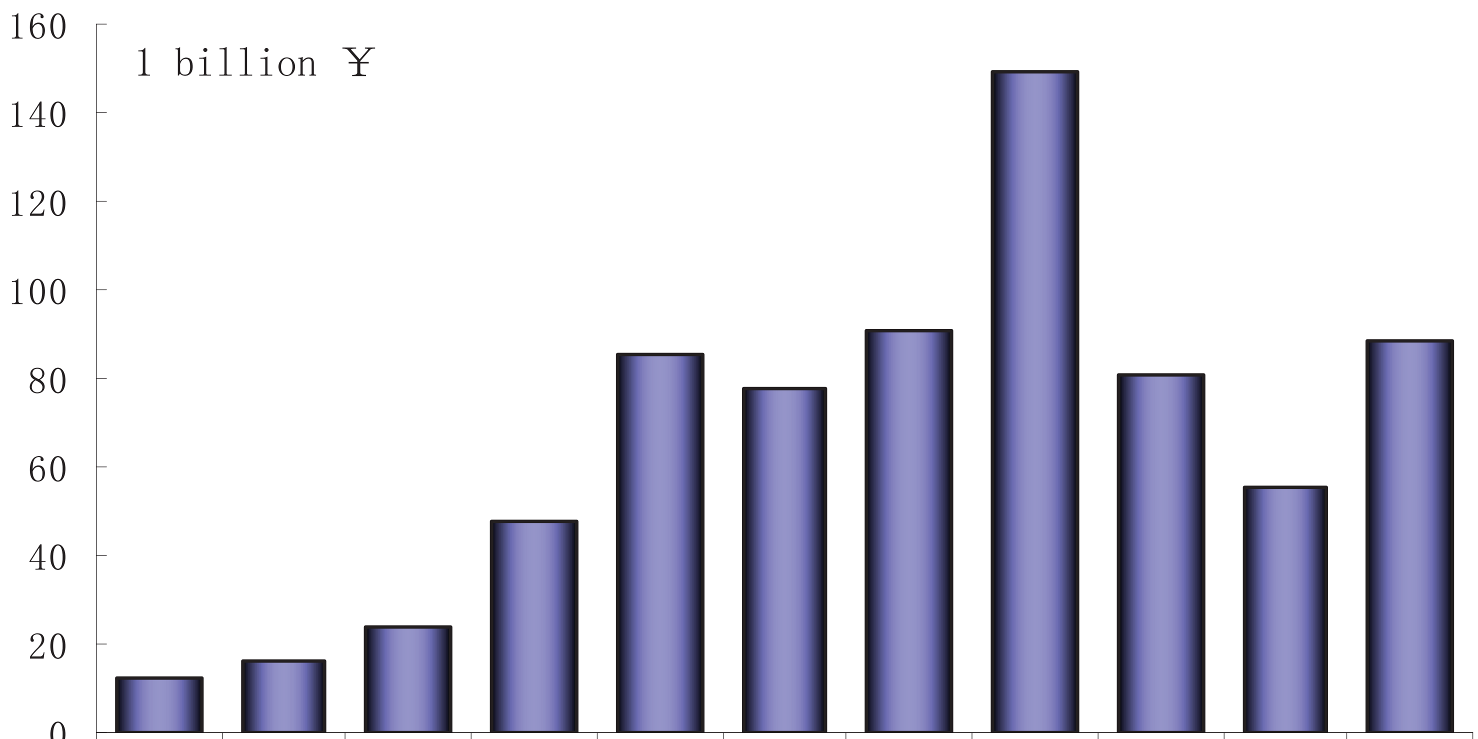


	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Import	6997	9231	11150	14812	20809	27523	32630	38309	44413	62778	61863
Price	26.5	27.1	24.8	32.8	61.1	66.8	64.1	88.2	133.5	79.9	128.4

Source from Customs

China's average price of import iron ore of 2010 picked up by 45.5 percent from 2007. SteelHome (China) Steel Price Index indicated that steel price in 2010 merely witnessed a rise of 5.9 percent compared with that of 2007.

CISA Members: Profits in 2000-2010



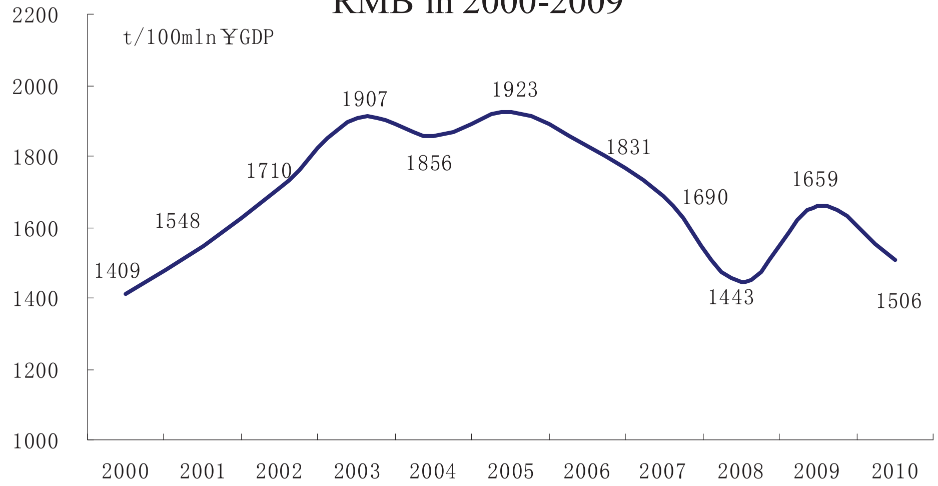
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
China	12.2	16.4	23.7	47.8	85.5	77.7	90.4	149.3	80.8	55.4	88.1

Source: CISA

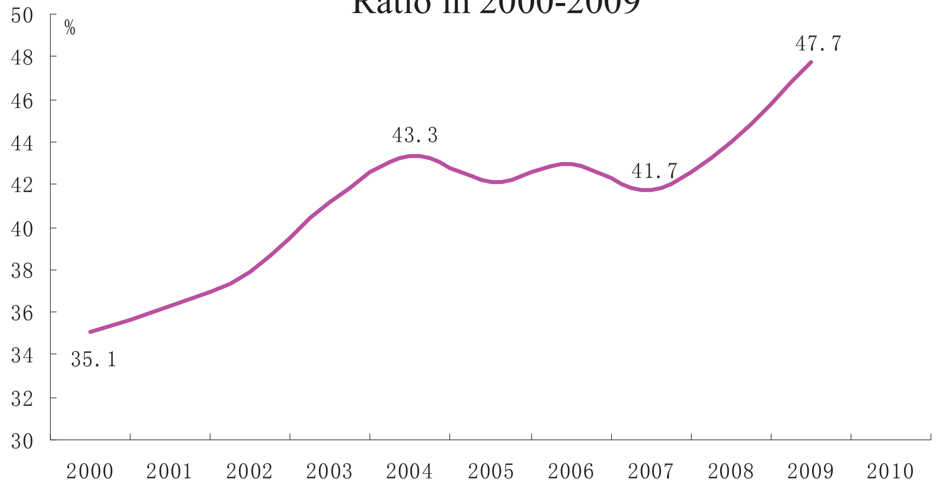
China crude steel production in 2010 was 627 million tonnes, up 28 pct over 2007. Profits of 77 leading steel mills reached CNY 88 billion, down 40.9 pct from 2007.

China to Accelerate Economic Restructuring

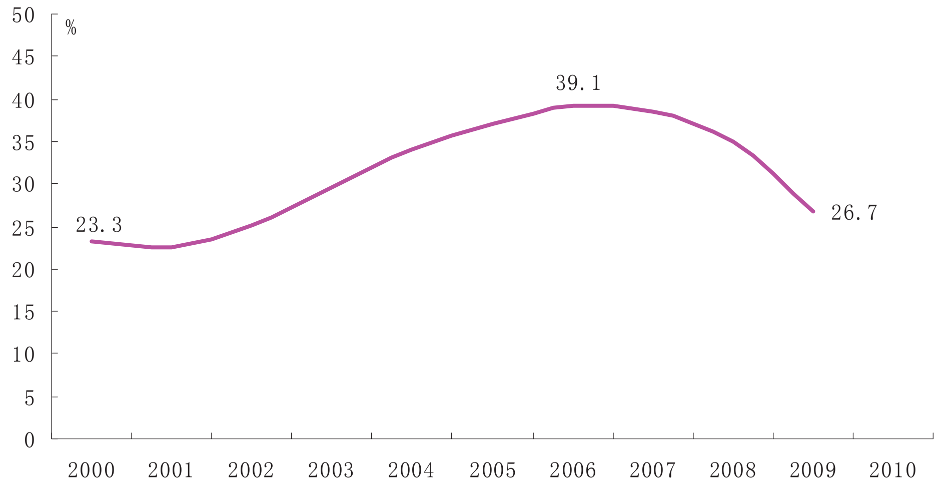
China Crude Steel Consumption per 100mln RMB in 2000-2009



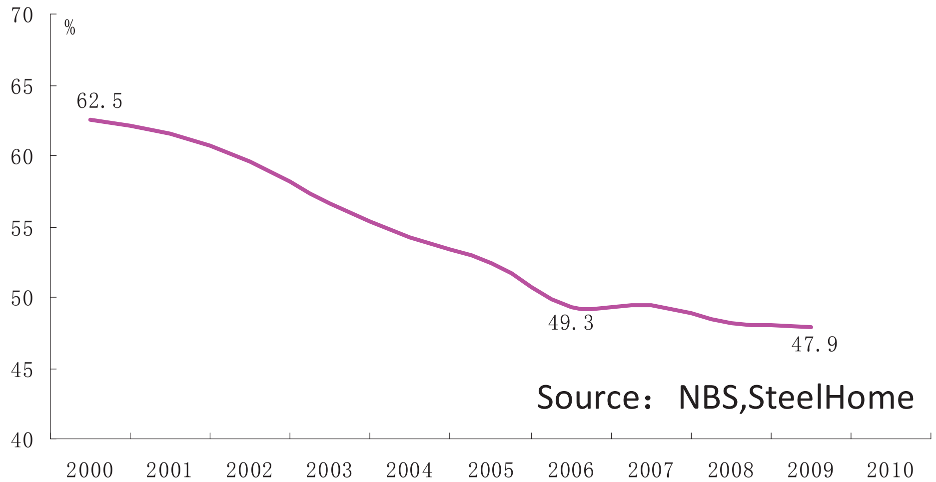
China Gross Fixed Capital Formation/GDP Ratio in 2000-2009



China Export/GDP Ratio in 2000-2009



China Consumption Rate in 2000-2009

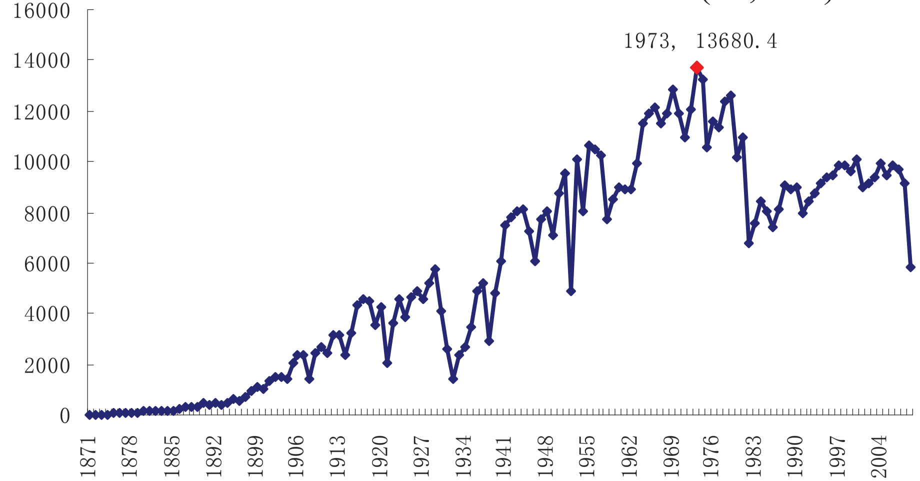


Source： NBS,SteelHome

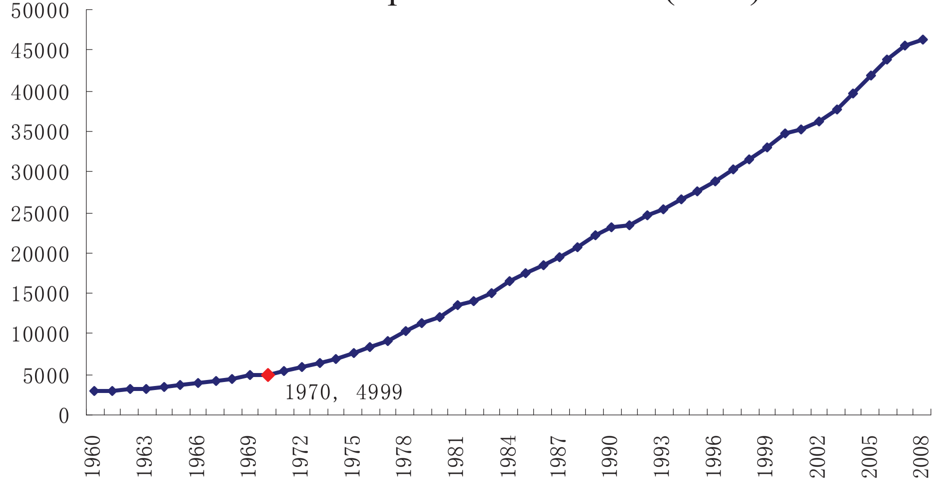
Chinese government will accelerate economic restructuring, and focus on boosting household consumption during the 12th Five Years encompassing 2011-2015. The move will reduce the steel consumption intensity. In other words, China will not sustain the fast growth of crude steel consumption although economy continue to advance.

In Advanced Countries, Crude Steel Production Peak Once GDP Per Capita Hit US$ 5000

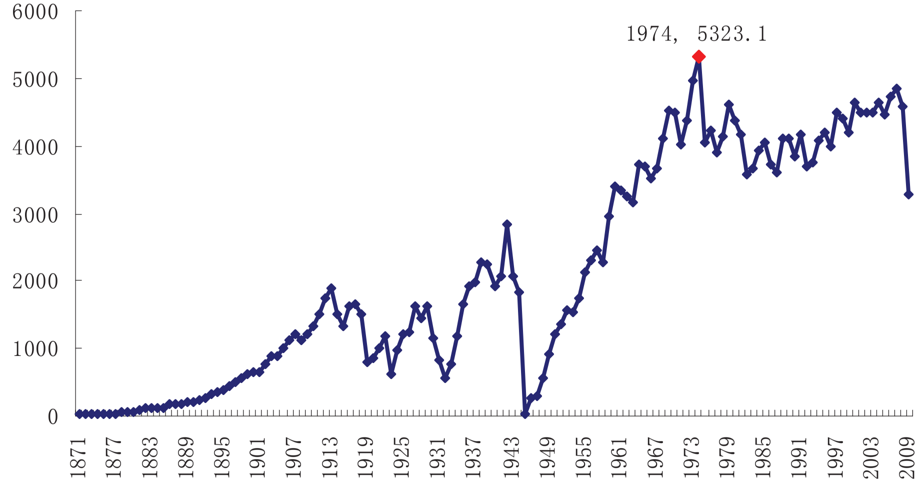
US Crude Steel Production in 1871-2009 (10,000t)



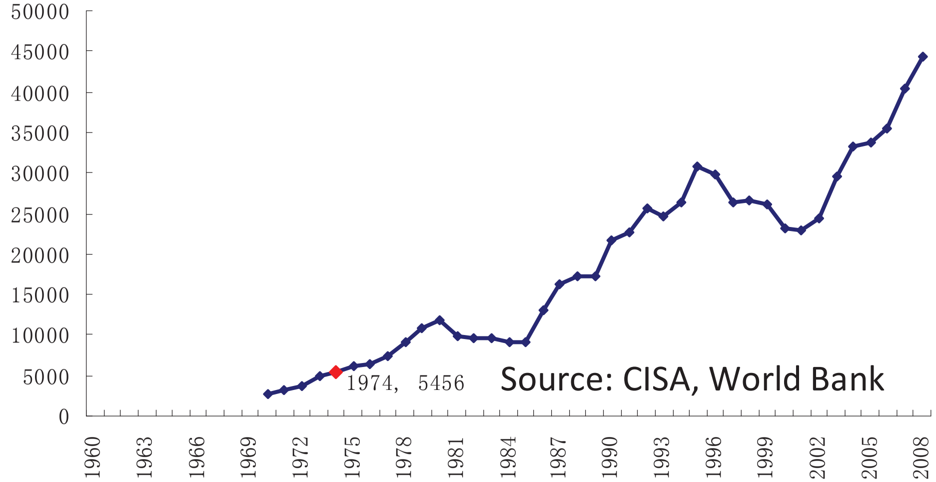
US GDP Per Capita in 1960-2008 (USD)



Germany Crude Steel Production in 1871-2009 (10,000t)



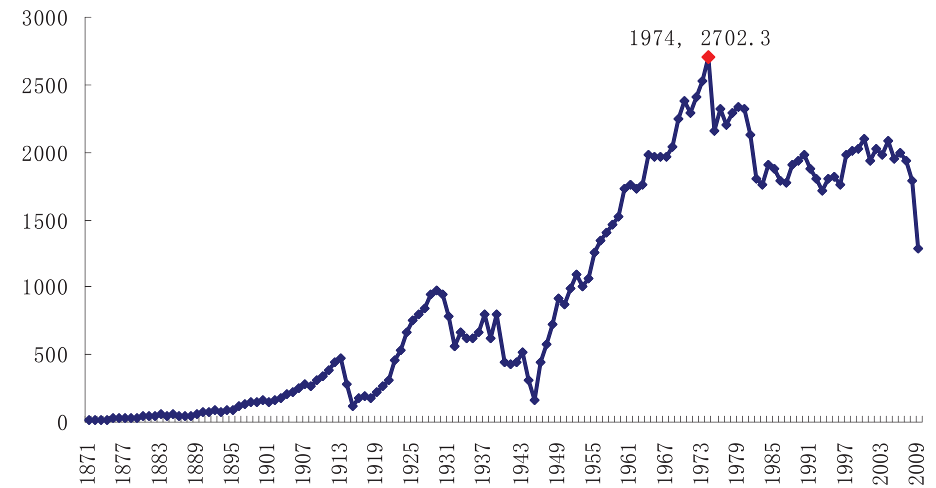
Germany GDP Per Capita in 1960-2008 (USD)



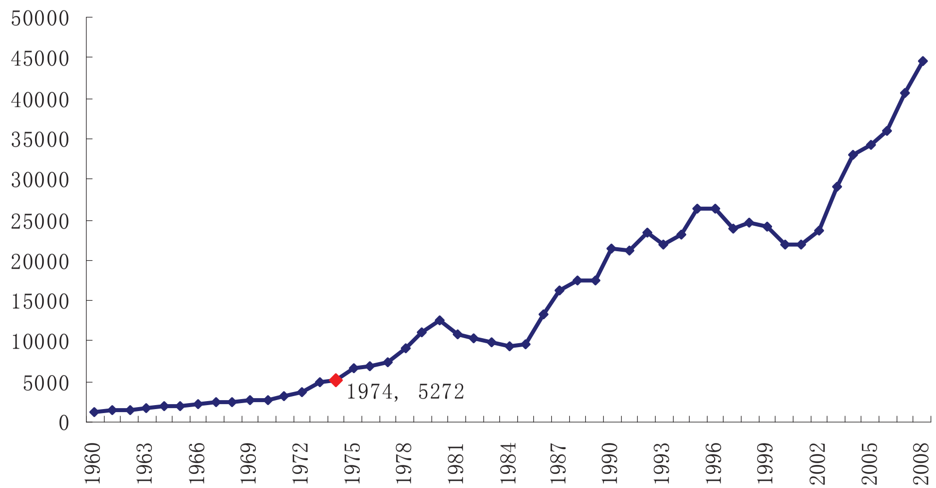
Advanced economies experience tells us that crude steel production hit the peak when GDP per capita comes to around US$ 5000.

In Advanced Countries, Crude Steel Production Peak Once GDP Per Capita Hit US$ 5000

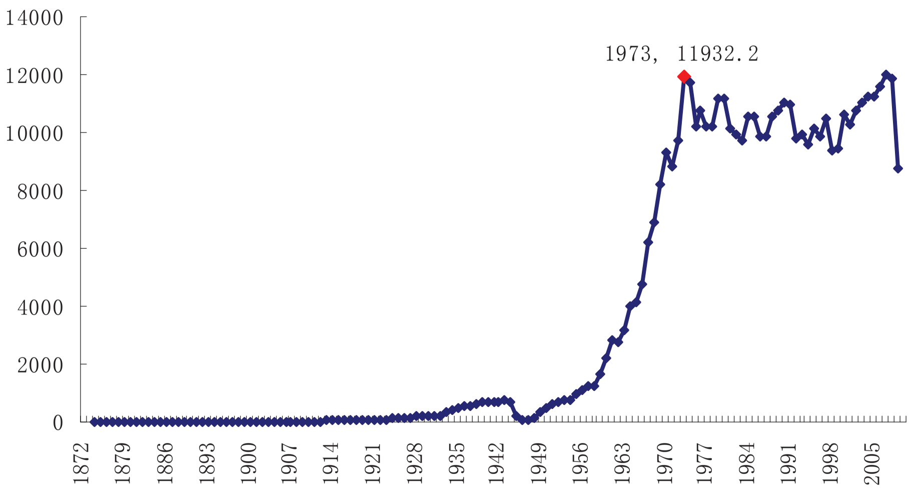
France Crude Steel Production in 1871-2009 (10,000t)



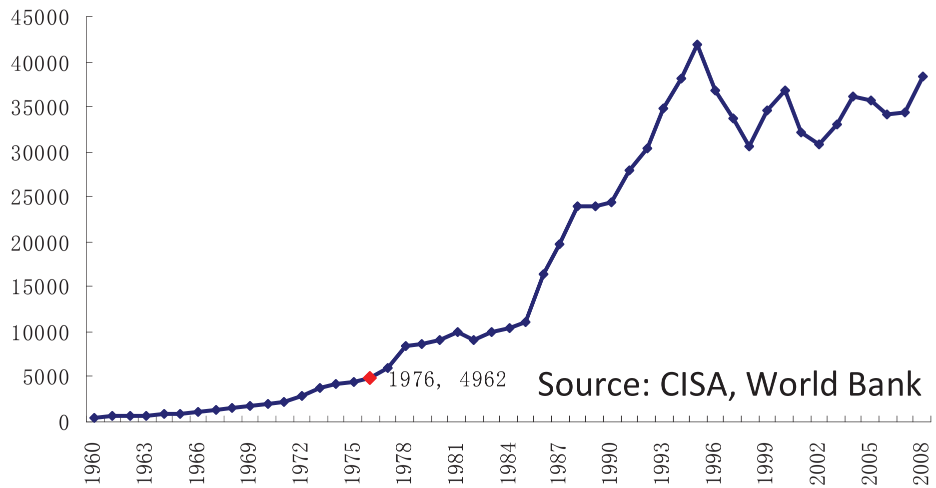
France GDP Per Capita in 1960-2008 (USD)



Japan Crude Steel Production in 1871-2009 (10,000t)



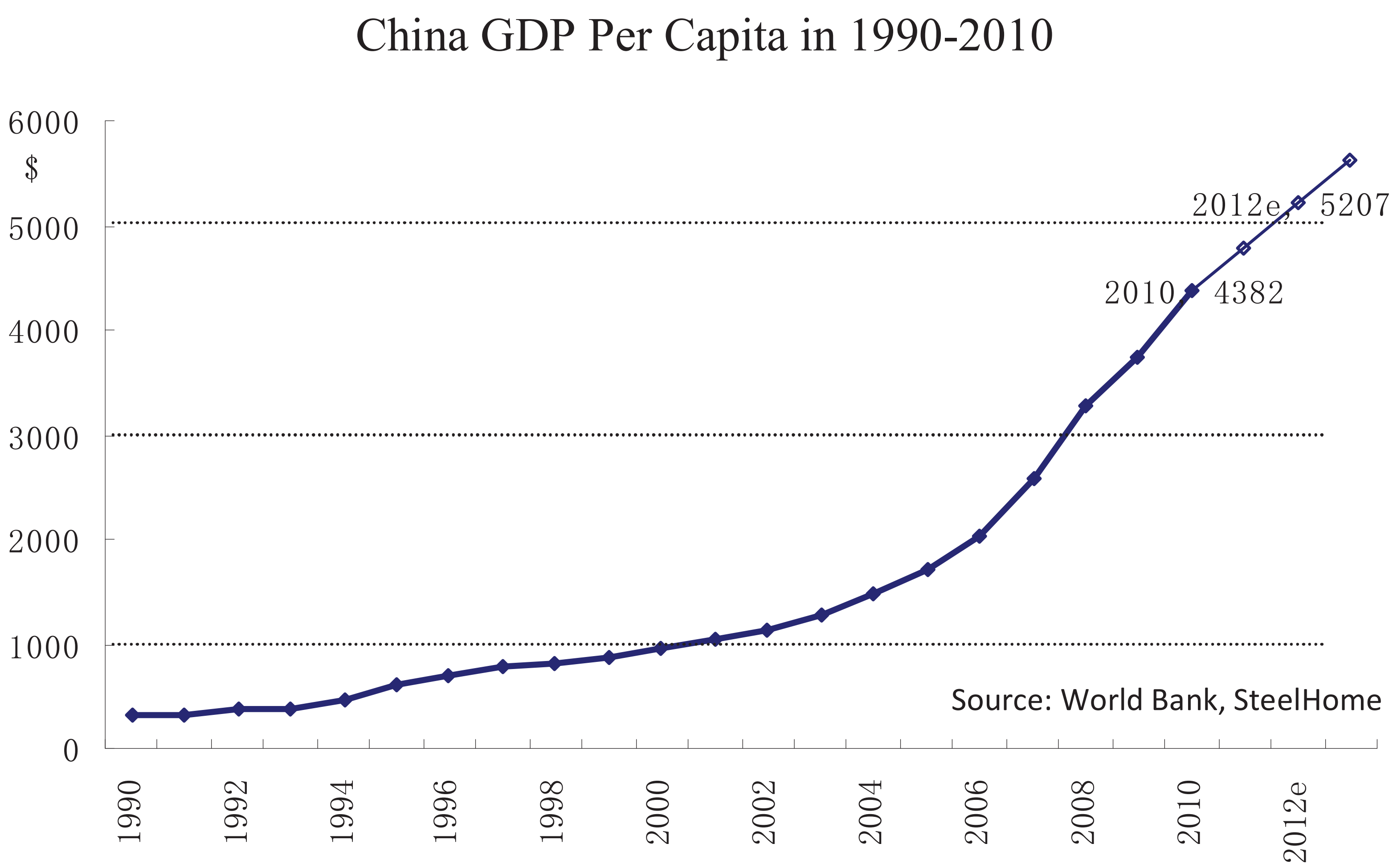
Japan GDP Per Capita in 1960-2008 (USD)



Source: CISA, World Bank

Advanced economies experience tells us that crude steel production hit the peak when GDP per capita comes to around US$ 5000.

China GDP Per Capita may Break US$ 5000 in 2012



China GDP per capita was US$ 4,382 in 2010, and it may hit or overtop US$ 5000 as of 2012 when the nation will walk into the post-industrialization.

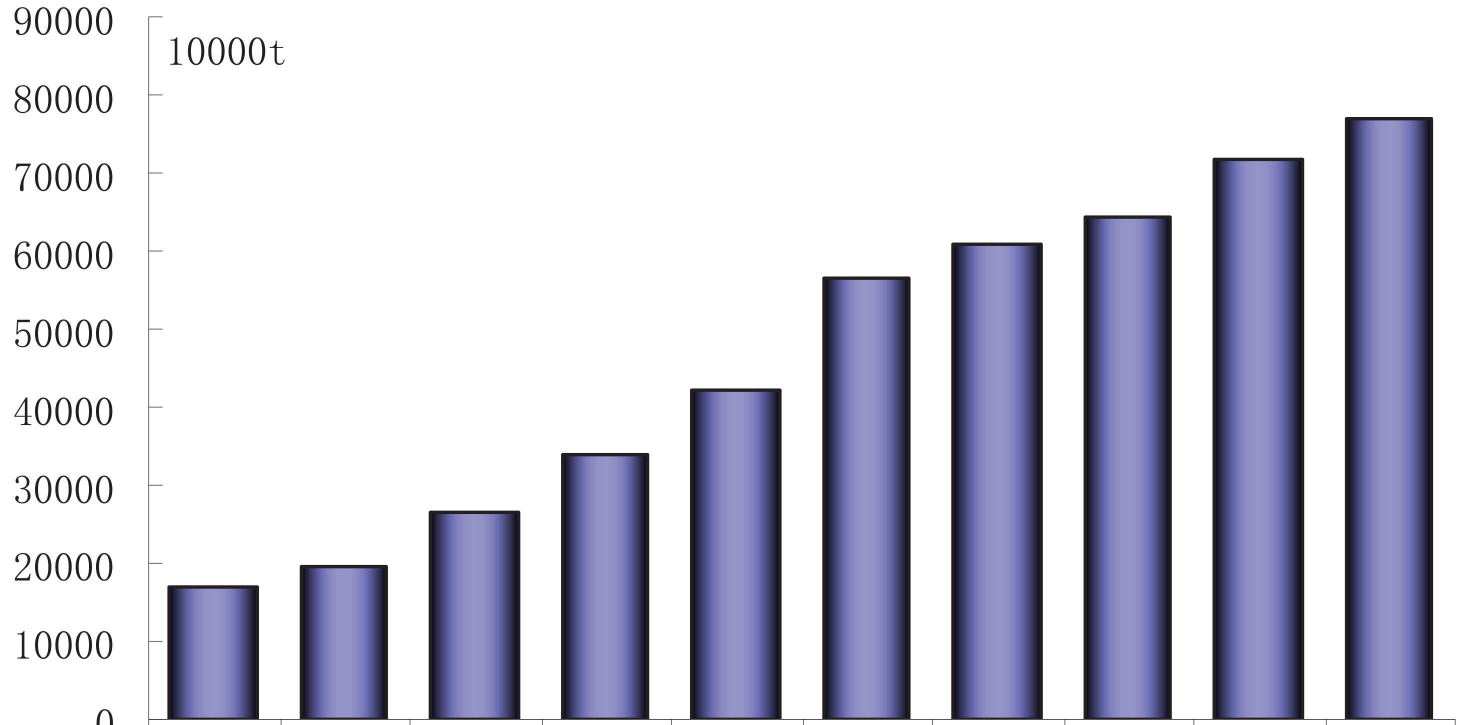
China GDP Per Capita in 2009

GDP Per Capita > US$ 5000			GDP Per Capita < US$ 5000					
Provinces	Population	GDP Per Capita	Provinces	Population	GDP Per Capita	Provinces	Population	GDP Per Capita
Shanghai	1921	11466	Jilin	2740	3889	Qinghai	557	2840
Beijing	1755	10137	Hebei	7034	3587	Hainan	864	2803
Tianjin	1228	8966	Chongqing	2859	3344	Sichuan	8185	2531
Jiangsu	7725	6530	Hubei	5720	3317	Jiangxi	4432	2528
Zhejiang	5180	6497	Heilongjiang	3826	3286	Anhui	6131	2403
Guangdong	9638	5997	Shaanxi	3772	3171	Guangxi	4856	2339
Inner Mongolia	2422	5887	Ningxia	625	3169	Tibet	290	2228
Shandong	9470	5240	Shanxi	3427	3143	Yunnan	4571	1976
Liaoning	4319	5156	Henan	9487	3006	Gansu	2635	1882
Fujian	3627	4939	Hunan	6406	2984	Guizhou	3798	1508
Total	47286		Xinjiang	2159	2901	Total	84375	

Source: NBS, SteelHome

From the table above, we can find ten provinces and cities in East China, with only 36 percent of the nation's population, have witnessed the process of post- industrialization, and crude steel consumption will decline. In comparison, the Central and West regions, with 64pct of nation's population, are in the middle of industrialization, and continue to back up China's steel consumption.

China Crude Steel Capacity Change during 2001-2010

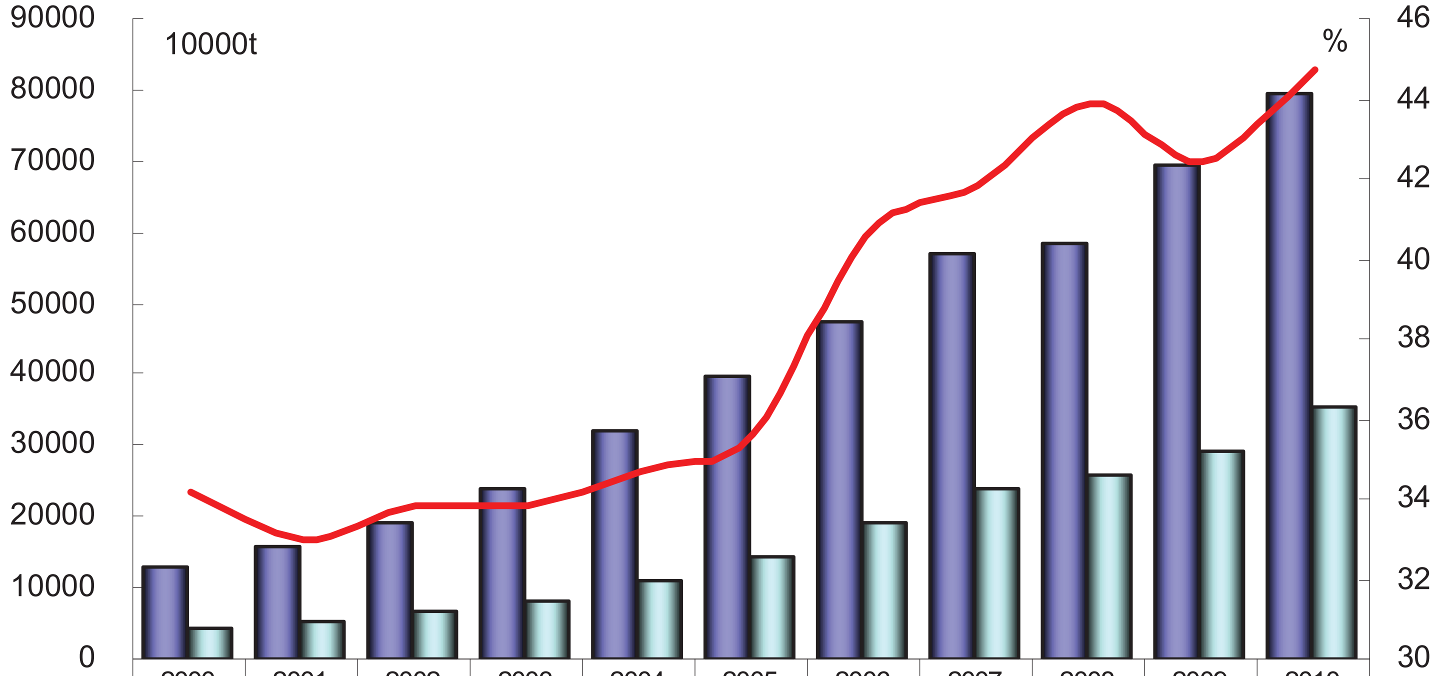


	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010E
capacity	17115	19735	26381	34103	42376	56315	61031	64431	71800	77000

Data Source: CISA

China crude steel capacity reached 770 million tonnes by the end of 2010 but actual capacity was 700 million tonnes as MIIT reported that China had phased out backward steel-making capacity of 68 million tonnes during 2006-2010. In 2011-2015, China will continue to eliminate backward capacity by 68 million tonnes. Meanwhile, local governments will not encourage steel industry expansion any more, under the pressure of the policy of reducing energy consumption and emission. China steel capacity growth pace will slow down further.

Chinese Steel Mills Accelerate Adjustment of Product Mix in 2006-2010

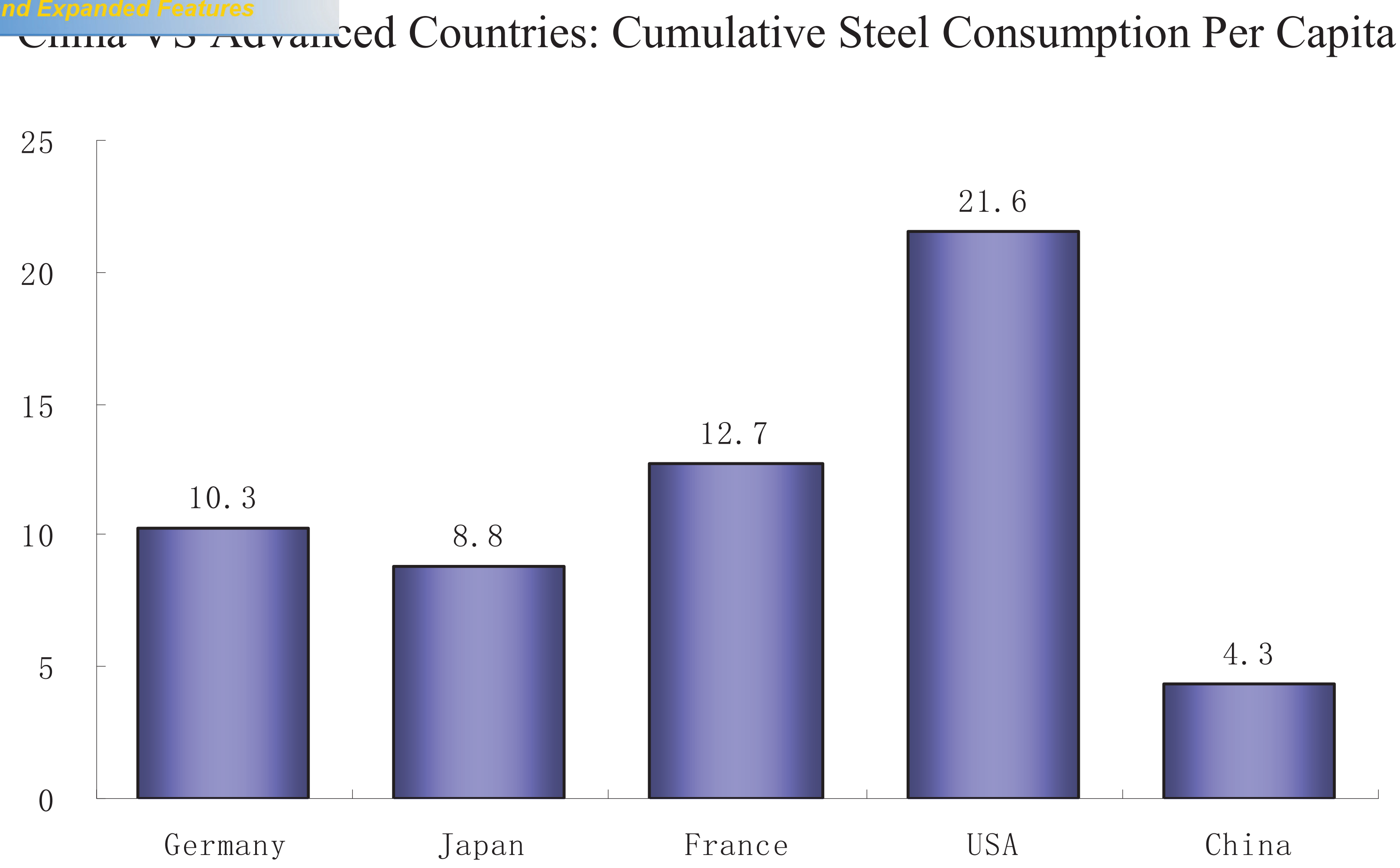


	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Steel products	13146	15702	19374	24041	31976	39692	47340	56894	58488	69244	79627
Flat products	4491	5184	6556	8138	11085	14152	19180	23819	25674	29403	35631
rate, %	34.2	33.0	33.8	33.9	34.7	35.7	40.5	41.9	43.9	42.5	44.7

Source from NBS

Since 2005, Chinese steel mills have attached greater importance on product mix adjustment and high value-added flats production. Flat products take increased proportion in steel production.

China: Cumulative Steel Consumption Per Capita Amount to 8.5 Tonnes in 2020



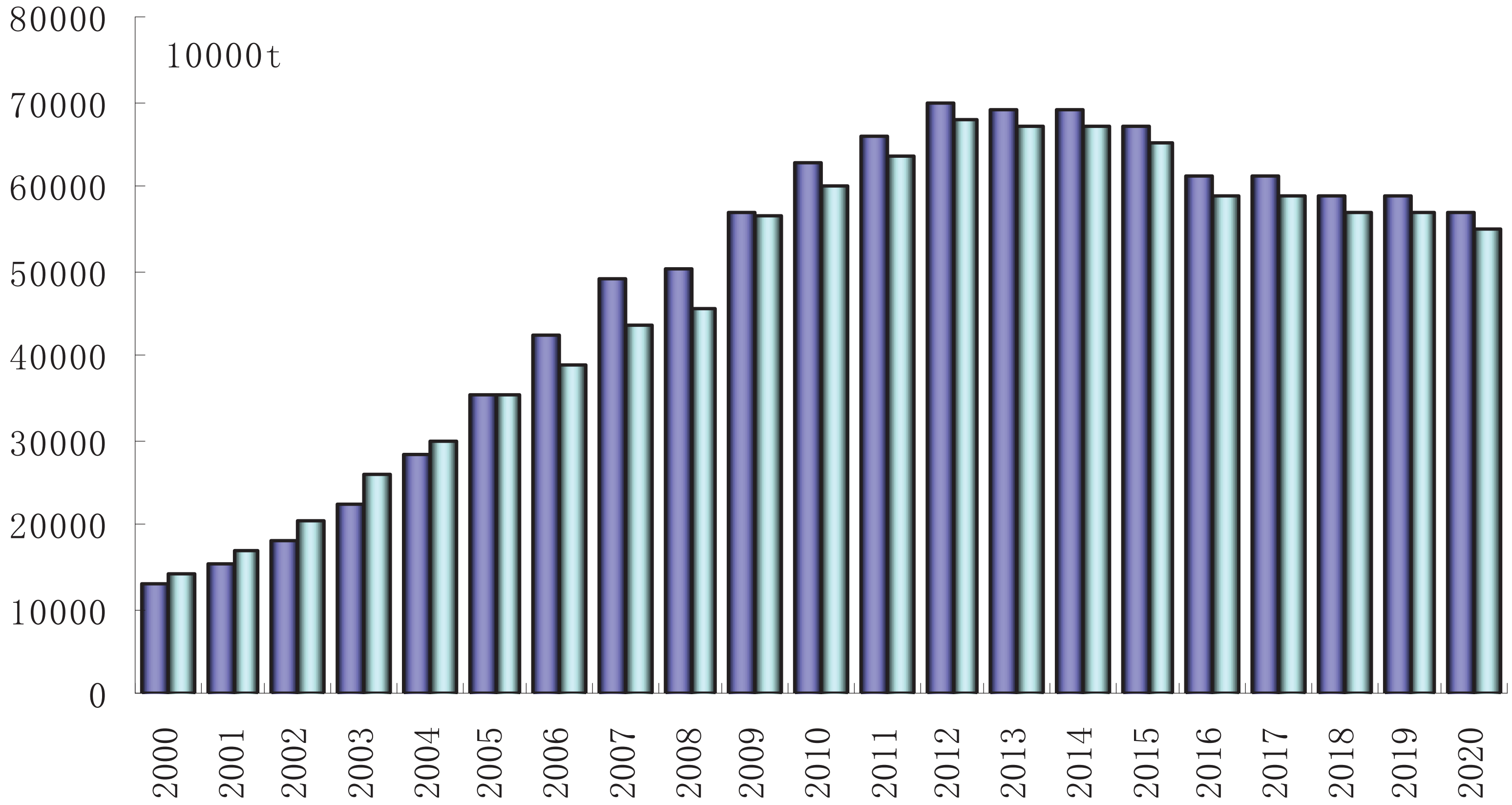
Source: CISA, Steelhome

Up to 2010, China cumulative steel consumption is 4.3 tonnes per capita, 4.5 tonnes less than Japan when walked into post industrialization (8.8 tonnes of Japan)

China still need to consume 6 billion tonnes of steel in order to achieve industrialization (8.5 tonnes consumption per capita), which will be realized by 2020 in light of current consumption rate.

China Crude Steel Production and Consumption May Approach or Reach the Peak in 2012

Forecast on China Crude Steel Production and Consumption in 2011-2020

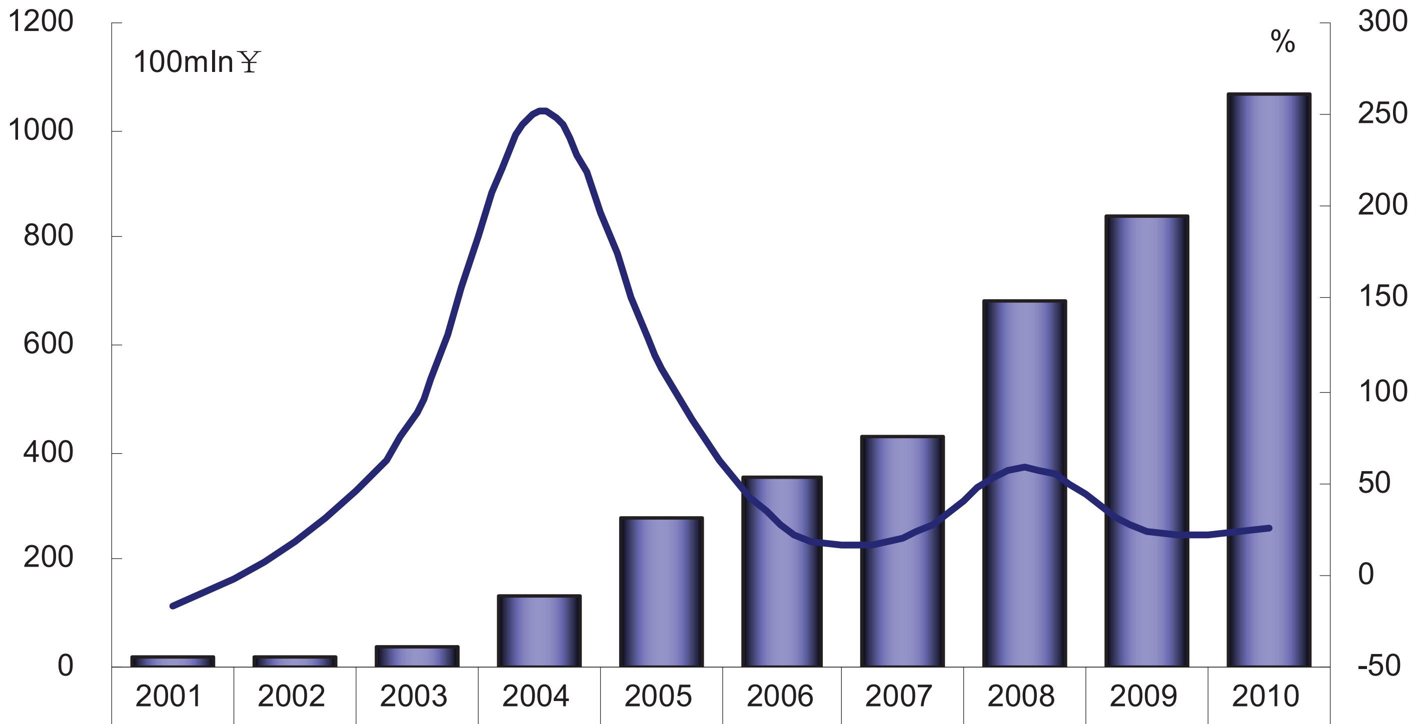


Data Source: Steelhome

China crude steel consumption may reach or close to peak by 2012 when the crude steel production hit 700 million tonnes and consumption arrive at 680 million tonnes. In 2013-2015, China crude steel production and consumption may maintain around the level. Thereafter, China crude steel consumption may show downward trend. By 2020, China crude steel consumption may decrease to 600 million tonnes or below. And China crude steel production will be based on the international demand.

China Iron Ore Investment Maintain Great Momentum to Rise

China Fixed Assets Investment on Ferrous Metals Mining and Dressing

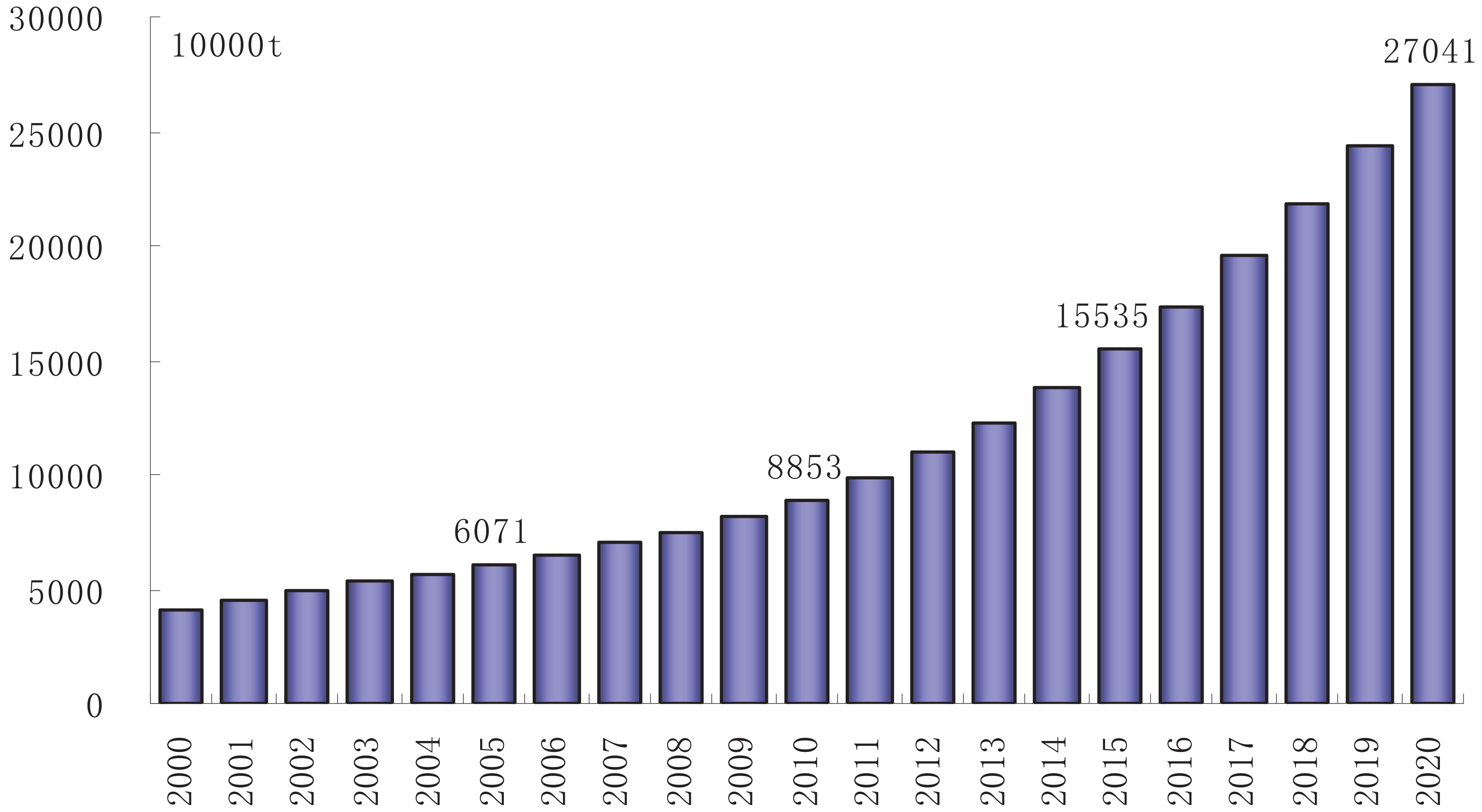


	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
100mln ￥	16.78	19.74	37.30	131.40	278.10	356.49	427.23	680.47	841.39	1066.22
growth，%	-17.7	17.6	89.0	252.3	111.6	28.2	19.7	59.0	23.9	26.4

Source： NBS

According to the statistics from Ministry of Land and Resources of China, a batch of large-scale mineral deposits have been detected, proved over 15 billion tonnes of iron ore reserves. During 2011-2015, China will invest 30 billion RMB in exploring new deposits in an attempt to reduce dependence on offshore minerals. It is expected that China domestic iron ore capacity will reach 1.5-1.6 billion tonnes and production roughly 1.45 billion tonnes around 2015.

China Obsolete Scrap Reservoir will Pick up Significantly in 2011-2020



Source from SteelHome

It is expected that obsolete scrap reservoir will amount to 155 million tonnes by 2015 and 270 million tonnes by 2020. Given the recycling rate of 70%, China scrap collection will be 100 million tonnes in 2015 and 190 million tonnes in 2020. By then, a tremendous increase will take place in scrap usage in the metallics charge.

China Iron Ore Imports will Decline after 2012

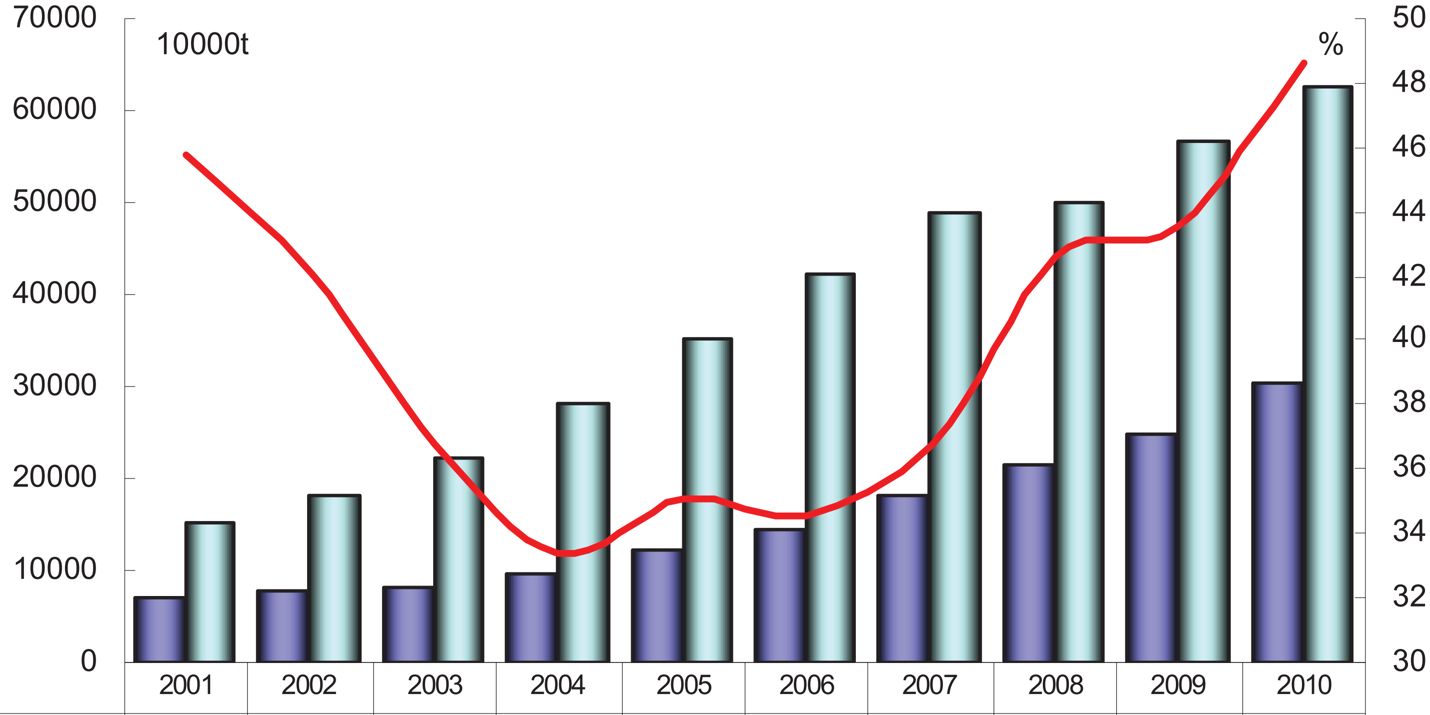
Global Metallics Balance in 2010-2015

Year	China						International Market				China iron ore imports+ global iron ore demand	Global iron ore production/capacity
	Crude steel production	Pig iron production	Domestic ore production	Iron ore import	Domestic scrap collection	Scrap import	Crude steel production	Pig iron production	Iron ore demand	Scrap collection		
2005	35239	34375	42049	27523	2428	1014	79090	51238	82641	36384	110164	110900
2006	42266	41245	58817	32630	3574	538	82820	52667	84946	39192	117576	121570
2007	48966	47652	70707	38309	4570	339	85650	54134	87313	40899	125622	129910
2008	50092	47067	82401	44413	6521	359	82620	52297	84350	39366	128763	137190
2009	56784	54375	88017	62778	5304	1369	65190	40808	65819	31566	128597	135400
2010	62665	59022	107156	61863	6500	500	78695	49754	82100	37559	143963	140000
2011	66000	62700	120000	63500	7100	500	81400	50800	83800	39000	147300	145000
2012	70000	66300	135000	64400	7800	400	85600	53400	88100	41000	152500	150000
2013	69000	64600	145000	58300	8600	400	87300	56100	92600	40000	150900	155000
2014	69000	63800	145000	56900	9500	400	89000	57900	95500	40000	152400	155000
2015	67000	60700	145000	51800	10600	400	90800	59800	98700	40000	150500	155000

Source： SteelHome

China's dependence rate on iron ore imports will be reduced. In 2015, obsolete scrap collection in China will reach 100 million tonnes, with an increase of 35 million tonnes versus 2010. In 2015, China domestic crude ore production will come up to 1.45 billion tonnes, increasing 380 million tonnes compared to 2010. Meanwhile, our dependence on offshore iron ore will go down to 50% from 63% of 2010.

China Steel Industry Consolidation in 2001-2010

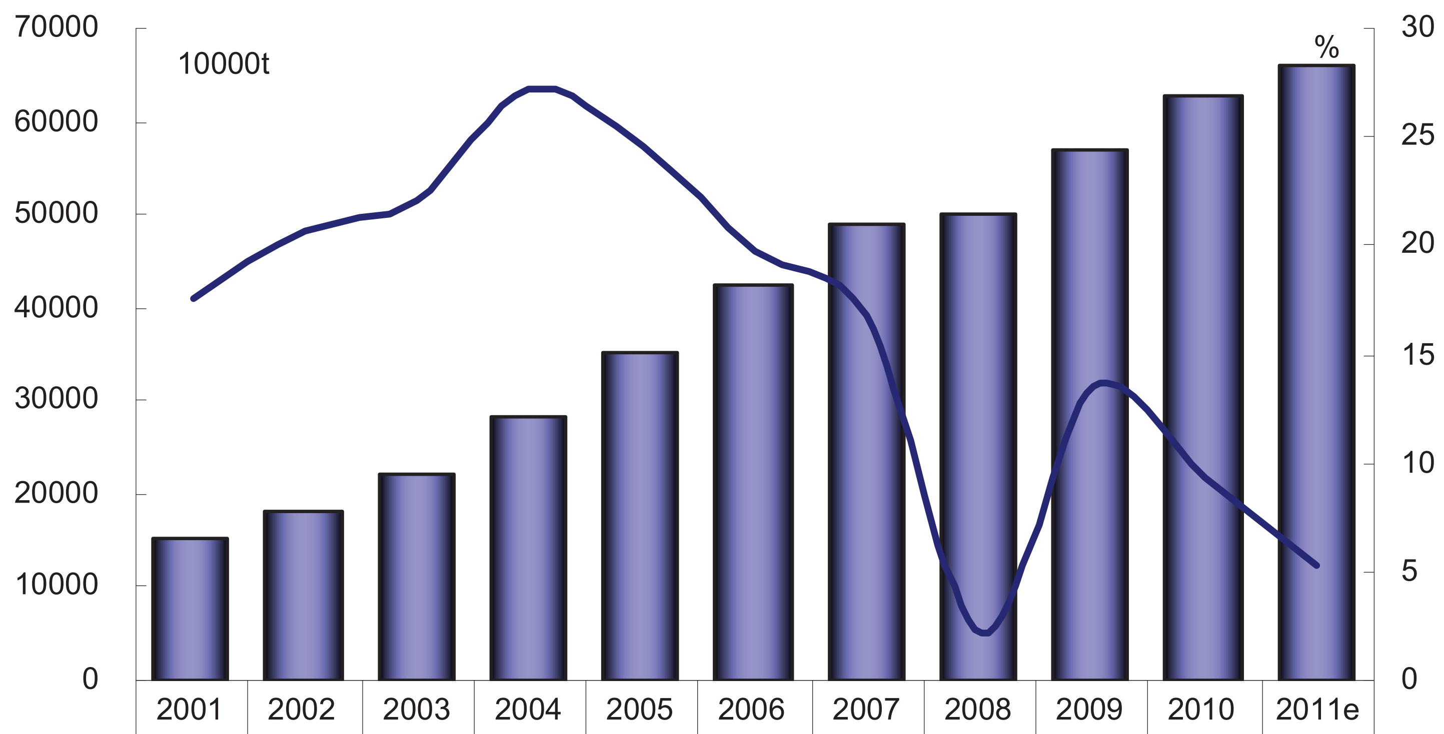


	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Top ten mills	6913	7666	8176	9457	12351	14593	17997	21337	24697	30473
China	15103	18225	22241	28291	35239	42266	48966	50092	56784	62665
rate%	45.8	42.1	36.8	33.4	35.0	34.5	36.8	42.6	43.5	48.6

Source： SteelHome

In 2010, Chinese top ten steelmakers took 48.6% in nationwide production, up 15.2pct over 2004. Chinese government will strengthen efforts on reducing energy consumption and emission and eliminating backward capacity. Medium and small players will be acquired by large steel groups under the competition. Steel giants with 80-100 million tonnes capacity will form in China in the near future.

China Crude Steel Production Estimated at 660 million tonnes in 2011

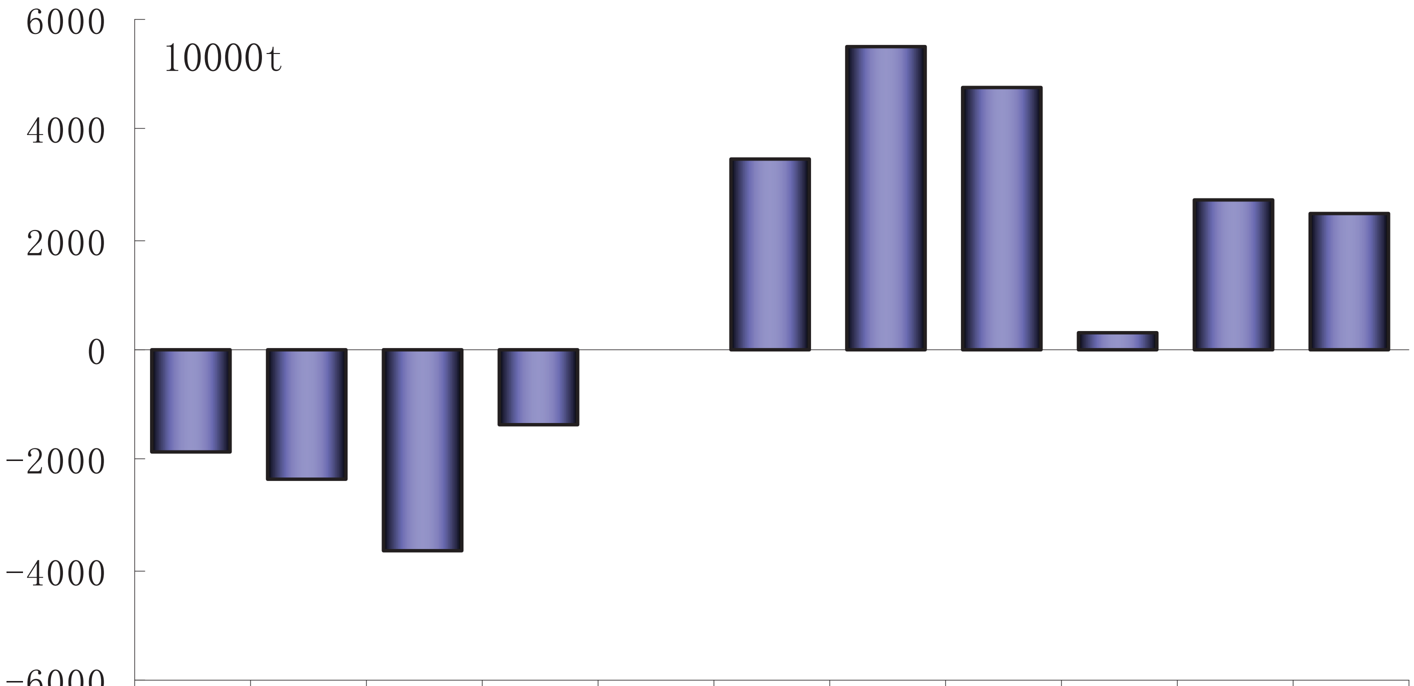


	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011e
production	15103	18225	22241	28291	35239	42266	48966	50092	56784	62665	66000
growth,%	17.5	20.7	22.0	27.2	24.6	19.7	16.8	2.1	13.5	9.3	5.3

Source： NBS，SteelHome

. China crude steel production may hike 5.3pct year on year to 660 million tonnes in 2011.

Net Exports of China Crude Steel in 2011 Stay Flat

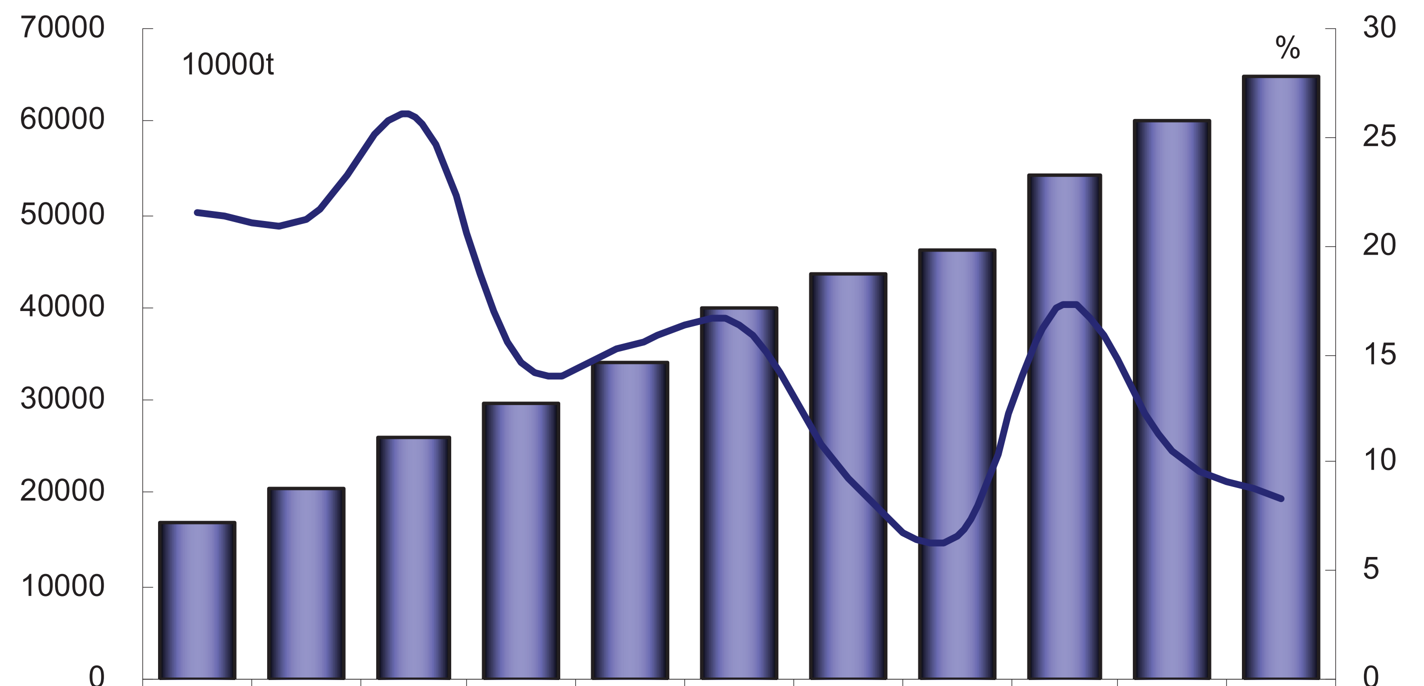


	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011e
Net. Export	-1874	-2352	-3655	-1384	12	3473	5489	4763	284	2730	2500

Source： Customs，SteelHome

In 2011, net exports of China crude steel may stay flat at 2010 level, 25-30 million tonnes.

China Crude Steel Demand to 650 million tonnes in 2011

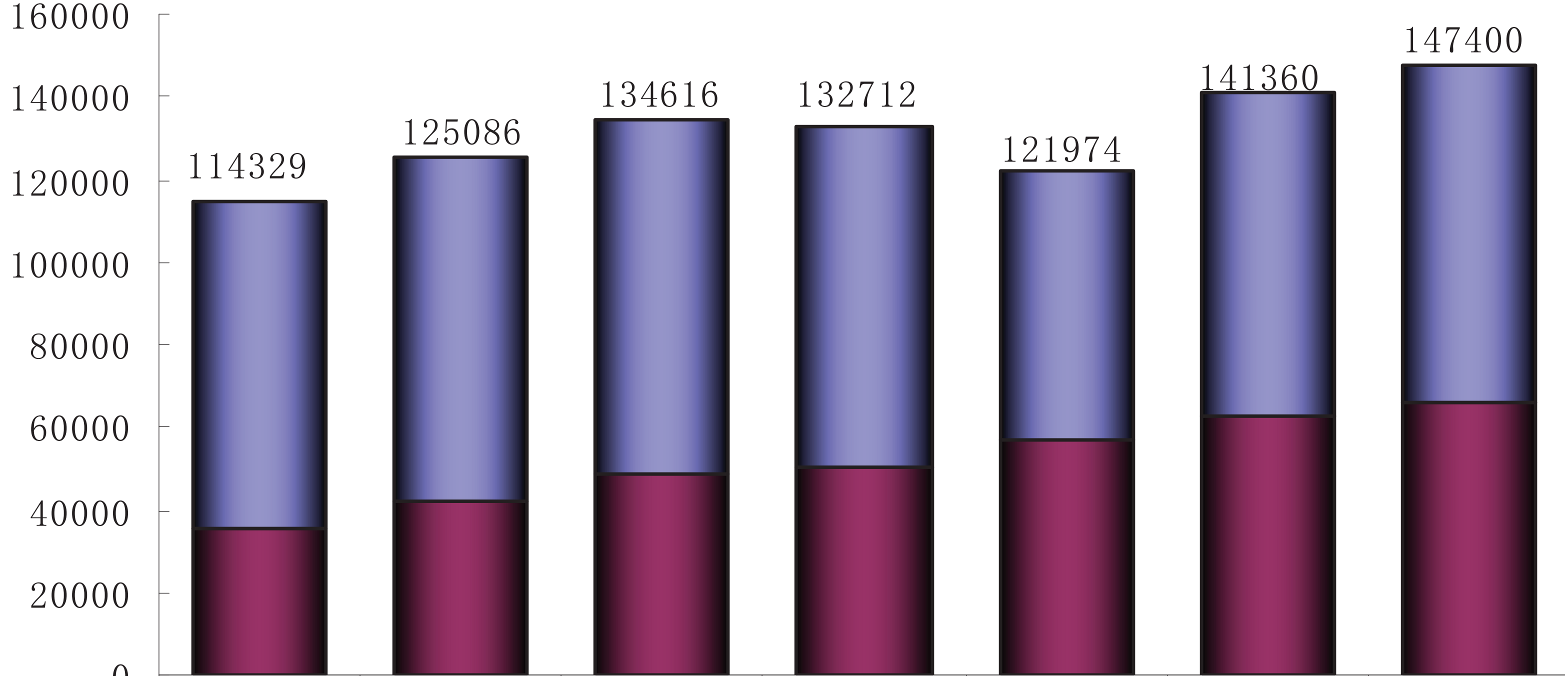


	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
consumption	16977	20577	25896	29675	34227	39793	43477	46328	54300	60000	65000
growth, %	21.5	21.2	25.9	14.6	15.3	16.3	9.3	6.6	17.2	10.5	8.3

Source： SteelHome

SteelHome forecast that China crude steel demand may be 650 million tonnes, apparent consumption may be 635 million tonnes in 2011. The balance in supply and demand will be realized by consuming inventory.

Global Steel Production may Hit New High in 2011



	2005	2006	2007	2008	2009	2010	2011e
ROW.	79090	82820	85650	82620	65190	78695	81400
China	35239	42266	48966	50092	56784	62665	66000

Source： SteelHome

Global steel production may hit new record to 1.474 billion tonnes in 2011. Therefore, raw material price will maintain high.

Conclusion

1.China steel development make great contribution to world steel industry.

1)China steel development is based on feeding domestic demand. In 2010, China crude steel production was 627 million tonnes, 4.9 folds of 2000; its apparent consumption was 600 million tonnes, 4.3 folds of 2000. The steel development match with economic growth.

2)China steel export will not threat international markets. During 2005-2010, China steel exports accounted for 7-15pct of production on crude steel basis, a ratio that was smaller than other countries. Chinese government boost domestic demand after financial crisis burst out. The exports slump, which play an important role in stabilizing international market.

3)China steel industry make great contribution to the boom of iron ore market, but China is badly hurt. In 2009, global iron ore trade amounted to 941 million tonnes, rising 439 million tonnes over 2000. China imported 628 million tonnes of iron ore in 2009, up 558 million tonnes over 2000. The additions in global iron ore trade are basically consumed by China. In 2010, international iron ore suppliers make full use of its monopoly to gain abnormal profits while China steel industry is in an awkward situation, rising production but declining profits.

Conclusion

2.China crude steel demand is close to the peak.

1)China GDP may attain or close to USD 5000 per capita in 2012, SteelHome predicts. During post-industrialization, Chinese government should adjust economic structure, downgrading investment and boosting consumption. Intensity of steel consumption will accordingly decline.

2)China development varies from region to region. Central and west China, with 64% of Chinese population, is still in the middle of industrialization, which may continue to maintain steel consumption at high level.

3)China cumulative steel consumption was 4.3 tonnes per capita by 2010, 4.5 tonnes lower than Japan, a typical developed country during the process of post industrialization. SteelHome believes that China still need another 6 billion tonnes steel to realize industrialization, therefore, China may fulfill the target in 2020 in the light of current consumption rate.

4)China crude steel consumption may approach or reach the peak in 2012, when crude steel production may be 700 million tonnes, and consumption around 680 million tonnes. During 2013-2015, production and consumption may maintain around the level. Thereafter, crude steel consumption will decline. By 2020, the consumption will gradually decline to 600 million tonnes or even lower. China steel production is determined by demand from international markets.

Conclusion

3.Till 2015, China's dependence rate on iron ore imports will decline from 2010's 63pct to 50%. China iron ore imports will decline after 2012.

1) China domestic crude ore capacity will reach 1.5-1.6 billion tonnes, and production 1.45 billion tonnes. China enhance its capacity to guarantee iron ore resources.

2)China obsolete scrap collection will reach around 100 million tonnes in 2015, rising 35 million tonnes over 2010. The collection will amount to 190 million tonnes in 2020. A substantial increase will take place in scrap usage in metallics charge.

3)China iron ore imports may remain high during 2011-2012 and then fall. In 2015, the dependence rate on imports may decrease to 50 pct from 2010's 63 pct.

4. Chinese top ten steelmakers will hold 48.6pct in production, 15.2 pct higher than 2004. Chinese government will continue to take aggressive measures in reducing energy consumption and backward capacities. Medium and small players may be acquired by large groups under the competition. Steel giants with 80-100 million tonnes capacity will form in China in the near future.

Conclusion

5 Forecasts on 2011 China Steel Market

1 China crude steel production may be 660 million tonnes in 2011, up 5.3pct or 30 million tonnes over 2010.

2 Net exports of China steel may be 20-30 million tonnes in 2011, same level with 2010.

3 Crude steel consumption may be 650 million tonnes in 2011, rising 8.3pct or 50 million tonnes over 2010.

4 Apparent steel consumption is estimated at 635 million tonnes in 2011, and the balance of supply/demand will be realized by consuming domestic inventory.

5 Global crude steel production may hit record high of 1.474 billion tonnes in 2011. Raw material market will be sustained high.

SteelHome（http://www.steelhome.cn）is dedicated to offering information and consultancy for steel industry at home and abroad, serving as the bridge among steelmakers, traders and end users to create business opportunities and provide more-than-expected value to steel parties.

SteelHome, ascended as one of the most influential websites in China steel industry, provide information and service to nearly 200 steel mills, such as Ansteel, Baosteel and the like, and over 14,500 steel distributors, metallic suppliers, governmental institutions, industry associations and research centers.

Address： 9th Floor, Zhongcheng Building, No 818, Dongfang Rd, Pudong New District, Shanghai, P.R.C 200122

Tel： 86-21-50581010 Fax： 86-21-50585277

E-mail: info@steelhome.cn

Thanks for SteelGuru's Invitation!

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Tom 27 2011 Zeszyt 3

IGNACIO HIDALGO GONZÁLEZ*, JACEK KAMIŃSKI**

The iron and steel industry: a global market perspective

Introduction

The iron and steel industry is a very complex sector which is intrinsically linked with the world economy as a whole. Steel products are needed by many industries, such as automotive, construction, and other manufacturing sectors. The steel industry uses significant amounts of raw materials (mainly iron ores, coal and scrap) and energy, and is also a major source of environmental releases such as (among others) emissions of dust, heavy metals, sulphur dioxide, hydrochloric acid, hydrofluoric acid, polycyclic aromatic hydrocarbons and persistent organic pollutants from sinter plants and coke ovens; waster water from pelletisation; dust and waste water from blast and basic oxygen furnaces; or emissions of filter dust, slag dust, and inorganic and organic compounds from electric arc furnaces (European Commission. 2011). Most raw materials are located remote from the areas of highest steel demand, and so both steel products and inputs are traded internationally and in large quantities. This trade is carried out mostly by sea-going vessels, with raw materials flowing from coal and ore-rich producing countries in South America, Africa and Oceania to major producing areas in Europe, North America, and the Far East, followed by shipments through rail and inland waterways, and semi-finished and finished steel products moving in the opposite direction. That has a particular impact on supply and demand patterns, and consequently on prices.

* PhD Eng. freelance engineer, postal address: CL Pablo Ruiz Picasso 2, 2 E; 11009 Cádiz, Spain; e-mail: ignacio.hidalgo.es@gmail.com

** PhD Eng. adiunkt, Instytut Gospodarki Surowcami Mineralnymi i Energią PAN, Zakład Polityki Energetycznej i Ekologicznej, Kraków; e-mail: kaminski@meeri.pl

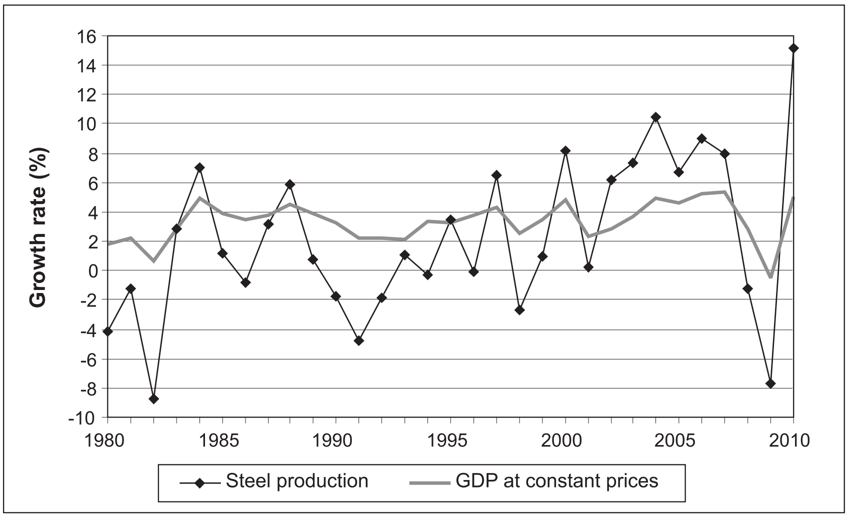

Fig. 1. World steel production and GDP growth rates
Source: (www.worldsteel.com and www.imf.org)

Rys. 1. Tempo wzrostu światowej produkcja stali oraz PKB

The steel industry consists of some large firms that operate globally and have a significant output, and many small firms that operate at a lesser scale. Recently, some of those firms have consolidated into large multinationals (such as ArcelorMittal, formed in 2006 by the merger of Arcelor and Mittal Steel, Arcelor being the result of the previous merger of Aceralia (ES), Usinor (FR), and Arbed (LX) in 2002, see section 2 for more details on the consolidation of the steel industries). The industry has been the subject of oligopolistic analyses since the 50s to date, either concentration index-based (Herfindahl 1950; Lee 2011), or model-based (Warrell, Lundmark 2008). However, despite the recent consolidation trends towards multinational companies, those analyses focus on specific countries and regions.

The aim of this paper is to provide an overview of the iron and steel industry, focusing on steelmaking technologies and international steel markets. The results of this paper will form the basis for further long- and mid-term analyses of the development of the global steel industry.

To this purpose, section 1 describes how steel is currently produced, section 2 shows the main characteristics of the steel markets, and section 3 concludes with some recommendations for further research.

1. Steelmaking technologies

Steel is a class of malleable alloys made up of iron and carbon (less than 2%), plus some other additives in small amounts (with proportions ranging widely from less than 1% for low alloy steels to more than 10% in the case of stainless steel or special steels for tools). Thus, there are many grades of steel (more than 3500) differing in composition and physical and chemical properties (Fenton 2005). Steel is one of the most important materials in the world, with applications in virtually all construction, manufacturing, and engineering-related fields.

Steel is produced by melting iron (in form of pellets, sinter, or DRI) and reducing its content of carbon down to the desired level. There are two basic production methods that account for most of the production (Worldsteel 2008):

— primary steelmaking (~72% of the global production),
— secondary steelmaking (~28% of the global production) (Worldsteel 2010).

Within the primary methods there are four possible production routes available at industrial scale, depending on the equipment used and on the region considered (Worldsteel 2010; Yellishetty, Ranjith, Tharumarajah 2010):

— a combination of a blast furnace (BF) with a basic oxygen furnace (BOF) (which accounts for ~64% of the world total production),
— a blast furnace with an open hearth furnace (OHF) (~1% of the global total),
— a direct reduction unit (DR) with an electric arc furnace (EAF) (~6% of the world total),
— a smelting reduction unit (SR) with a basic oxygen furnace (less than 1% of the world total).

Primary steelmaking involves up to four major steps which require large facilities:

1) mining and preparation of raw materials,
2) iron production,
3) steel production,
4) casting, rolling and finishing.

The main raw materials are iron ore, coal, limestone, scrap and energy. Approximately 95% of the energy input consists of solid fuels (mainly coal), ~3% of gaseous fuels, and ~2% of liquid fuels; electricity input is much smaller (Worldsteel 2008).

The secondary method produces steel by recycling used steel products and ferrous scrap in electric arc furnaces. Secondary steelmaking usually involves stages 3 and 4. The main inputs are scrap and electricity.

1.1. Mining and preparation of raw materials

The first step to produce steel by means of a primary steelmaking method consists of the mining and preparation of raw materials. The most important raw materials are iron ore, coke, limestone, and ferrous scrap. Iron ore is mostly obtained from open cast mines, then crushed and concentrated into pellets (small iron ore balls) or sinter (iron ore lumps baked with coke or coal). Iron ore is mined in about 50 countries, the majority originating from Brazil, Australia, China, India, the US and Russia. Australia and Brazil accounting together for about one third of total world exports (Worldsteel 2010). Iron mines are often remote from steel mills, so iron ore needs to be transported by rail to dedicated port terminals, and then shipped in bulk carriers to steel producing locations (Yellishetty, Ranjith, Tharumarajah 2010).

Coking coal is mined from open cast or underground mines, washed, and converted into coke (almost pure carbon resulting from conversion of coal without oxygen at high temperatures). The quality of the coking coal, or rather a specific mixture of selected coals, directly influences the final coke quality. In fact the coke quality is more dependent on the coal mixture than on the coke production technology. As a result, prices of selected coking coals (premium hard, hard) are significantly higher than prices of semi-soft coals (even by 30–50%). Coke producers are usually located in the steel producing regions. In 2007 the Asian countries produced 406.5 Mt of coke out of the world total 554.2 Mt, with China being the biggest producer (329 Mt of coke (recalculated for dry coke)). Poland and Germany are the main EU coke producing countries with annual production of 10.3 Mt and 8.10 Mt respectively (Ozga-Blaschke 2010).

Scrap iron consists of steel and ferrous products at the end of their lifetime (obsolete scrap), steel discarded during the manufacturing processes (prompt scrap: by sector, steel recovery rates can be estimated at 85% for construction, 85% for the automotive industry, 90% for manufacturing of machinery, and 50% for electrical appliances), or any scrap generated within the steel industry and immediately fed back into the steelmaking process (home scrap). The availability of home and prompt scrap is related to current production levels, while the levels of obsolete scrap depends on past steel production, average product lifetimes, and recycling rates (Worldsteel 2011).

Limestone is used in the furnaces to form slag (a by-product resulting from impurities and non-metallic inclusions into the steelmaking processes, which may be used in the production of concrete in combination with Portland cement). Other additives like metals, plastics and heavy oil may be used in the different production phases.

1.2. Pig Iron Production

In the second step, hot metal (or molten iron, also known as pig iron when solidified) may be produced by two means:

— either charging iron ore and coke to a blast furnace,
— by reducing iron ore with natural gas or low quality coke (this can be done in direct reduction units, which may be shaft furnaces, rotary kiln furnaces, or fluidized beds).

The blast furnace-based process uses sinter, pellets, lump ore and coke. All the inputs are charged to the top of the furnace, and heated to remove oxygen from the iron ore and produce the hot metal.

The direct reduction process uses pellets, lump ore, and natural gas (or low quality coke) to reduce the iron ore. Pellets and lump ore are heated under pressure in the presence of natural gas and reduced to DRI (direct reduced iron: pelletized iron).

1.3. Steel Production

In the third phase the steel is produced by oxidizing the hot metal (or direct-reduced iron (DRI)). There are three possible furnaces to produce the steel:
— open hearth furnace (OHF),
— basic oxygen furnace (BOF),
— electric arc furnace (EAF).

The BOF is a vessel where oxygen is injected into the hot metal to remove carbon and other impurities. The BOF can take a mixture of hot metal, scrap and DRI. The OHF is similar to the BOF, but much slower and with a higher energy input, and therefore is not competitive with the BOF and has become obsolete. In these two furnaces, the energy that drives the steelmaking process comes from the heat of the hot metal charge and from the combustion of the contained carbon. The EAF can take a full charge of scrap or DRI (mixtures are also possible), and requires electricity to melt the cold charge.

1.4. Casting, rolling and finishing

During the fourth step, once the crude steel is produced by any of the processes described above, it is transferred to an ingot casting shop (where ingots are produced in batches by pouring steel into moulds) or to a continuous casting shop (where liquid steel is poured continuously and then cut into the desired shapes). The semifinished products obtained from the casting processes are ingots (blocks), slabs (a length of metal with rectangular cross-section), billets (a length of metal with round or square cross-section), or blooms (similar to billets, with greater cross sectional area). These semifinished products are later rolled into different shapes. Slabs are converted into thinner steel plates (flat products) in plate mills or hot strip mills. Other finished shapes (long products) are rolled from blooms and billets into beams, reinforcing bars, and wire rods through different types of mills. Further treatments (coating, annealing, galvanizing, tinning, etc.) are provided in specific finishing mills.

Figure 2 shows a sketch of the primary and secondary steelmaking methods outlined previously.

1.5. Energy use and emissions

The steel industry is highly energy-intensive and very dependent on the use of fossil fuels. At the global level, energy flows within the iron and steel industry are rather complex, since energy is simultaneously converted (e.g. from coking coal into coke) and consumed by the steel production processes. In Table 1, the first two columns show the transformation components of the steel industry's energy balance in 2006. Globally, blast furnaces consumed 13.58 Mtoe of coal and peat, and 3.23 Mtoe of petroleum products, and generated 10.69 Mtoe of gas products which were usually re-used somewhere else within the steel industry.

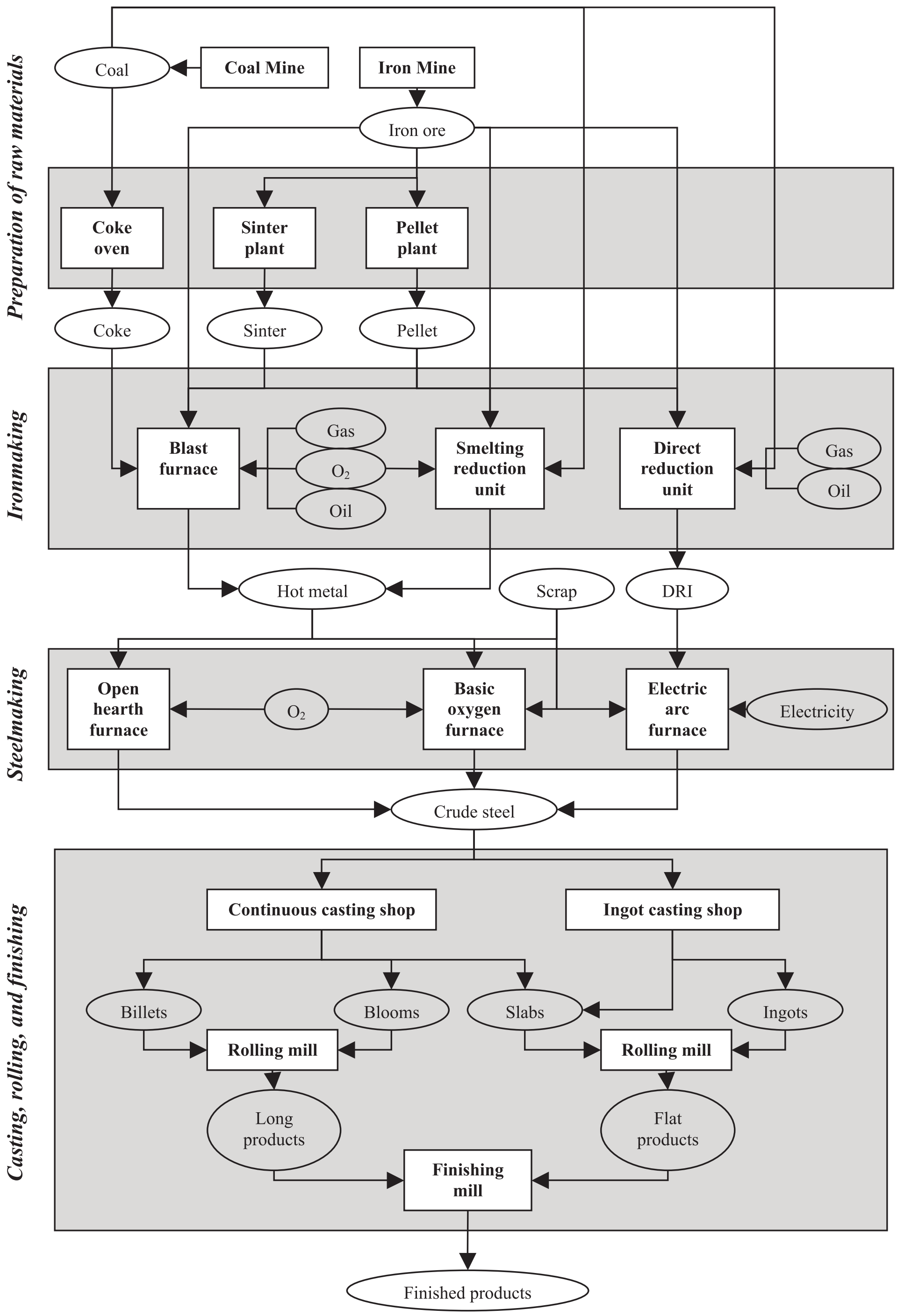

Fig. 2. Steel production routes

Rys. 2. Ścieżki procesu produkcji stali

The transformation of coking coal into coke required the consumption of 187.56 Mtoe of energy inputs, mostly coking coal. The rest of the steel production processes required an energy input amounting to 384.64 Mtoe in 2006, most of which consisted of coal and peat (54.27%), electricity (22.08 %), and gas (14.90%) (fuel categories as defined by the IEA (IEA 2008).

TABLE 1

Global energy balance of the iron and steel industry in 2006

TABELA 1

Globalny bilans energii produkcji żelaza i stali w 2006 r.

Fuel	Energy supply[A] (Mtoe)		Final consumption[B]	
	Blast furnaces and gas works	Coal transformation[C]	Mtoe	%
Coal and peat[D]	–13.58	–184.6	208.75	54.27
Crude oil[E]	0.00	0.02	0.01	0.00
Petroleum products[F]	–3.23	–2.8	14.81	3.85
Gas[G]	10.69	–0.17	57.32	14.90
Renewables and waste	0.00	–0.01	6.2	1.61
Electricity	0.00	0.00	84.92	22.08
Heat	0.00	0.00	12.62	3.28
Total	–6.12	–187.56	384.64	

[A] – Production plus imports minus exports, plus stock changes.

[B] – This column includes final energy consumption due to all activities under ISIC's (International Standard Industrial Classification of All Economic Activities) Group 271 and Class 2731. More details about the ISIC registry system are available at http://unstats.un.org/unsd/cr/registry/isic-4.asp.

[C] – Coal transformation contains losses in transformation of coal from primary to secondary fuels and from secondary to tertiary fuels (hard coal to coke, coke to blast furnace gas, lignite to BKB (brown coal briquettes), etc.). It is often difficult to correctly account for all inputs and outputs in energy transformation industries, and to separate energy that is transformed from energy that is combusted. As a result, in certain cases the data in the total column are positive numbers, indicating a problem in the underlying energy data. Coke/patent fuel/BKB plants covers the use of fuels for the manufacture of coke, coke oven gas, patent fuels and BKB.

[D] – Includes all coal, both primary (including hard coal and lignite/brown coal) and derived fuels (including patent fuel, coke oven coke, gas coke, BKB, coke oven gas, blast furnace gas and oxygen steel furnace gas). Peat is also included in this category.

[E] – This row comprises crude oil, natural gas liquids, refinery feedstocks, and additives as well as other hydrocarbons (including emulsified oils, synthetic crude oil, mineral oils extracted from bituminous minerals such as oil shale, bituminous sand, etc., and oils from coal and gas liquefaction).

F – Petroleum products comprise refinery gas, ethane, LPG, aviation gasoline, motor gasoline, jet fuels, kerosene, gas/diesel oil, heavy fuel oil, naphtha, white spirit, lubricants, bitumen, paraffin waxes, petroleum coke and other petroleum products.

[G] – This row includes natural gas (excluding natural gas liquids) and gas works gas. The latter appears as a positive figure in the "gas works" row but is not part of production.

Source: IEA 2008.

With this energy mix, the iron and steel industry is also a major source of greenhouse gas (GHG) emissions and air pollution. Global direct CO_2 emissions from final energy consumption in the iron and steel industry amounted to 1035.39 Mt CO_2 in 2006, i.e 3.70% of total CO_2 emissions from fuel combustion. Direct emissions are calculated from the figures presented in Table 1, multiplying the final consumption levels by the appropriate carbon content (expressed in tC/TJ: 25.8 for coal and peat, 20 for crude oil and petroleum products, 15.3 for gas, and 29.9 for renewables and waste) and conversion factors (1 Mtoe = 41868 TJ); electricity-related and process emissions from BF and coke oven plants are not included in the estimation. Most of the emissions were caused by the use of coal (826.80 Mt CO_2), then gas (134.63 Mt CO_2), petroleum products (45.47 Mt CO_2), and solid biomass (28.46 Mt CO_2).

Note that in Table 1 the column "blast furnaces/gas works" covers the quantities of fuels used for the production of town gas, blast furnace gas (BFG) and oxygen steel furnace gas (BOFG). The production of pig iron from iron ore in BF needs the use of solid fuels for physically supporting the blast furnace charge and providing heat and carbon for the iron reduction process. Accounting for the calorific content of the fuels entering the process is a complex matter as transformation (into BFG) and consumption (heat of combustion) occur simultaneously. Some carbon is also retained in the pig iron; almost all of this reappears later as BOFG (or converter gas) during the steelmaking phase. In principle, the quantities of all fuels entering BF and the quantity of BFG and BOFG produced are collected in the energy statistics. However, most of this data is frequently reported as being uncertain or incomplete. IEA splits these inputs into the transformation and consumption components. The transformation component is shown in the column "blast furnaces/gas works" in the row appropriate for the fuel, and the consumption component is shown in the column "final consumption" in the row appropriate for the fuel. It is assumed an 80/20 split of coke oven coke between the transformation and consumption components (IEA 2008).

Energy intensity depends on the steelmaking process used, the characteristics of the raw material inputs, and the grade of the steel produced, and also differs between facilities with different degrees of energy and material efficiency. Table 2 shows typical ranges of energy intensity and raw material inputs per ton of crude steel by production route (all steps but mining are included).

Primary steelmaking is more energy-intensive than secondary steelmaking; although the by-product gases from coke ovens, blast furnaces, and basic oxygen furnaces can be fully reused (those gases contribute up to ~40% of the energy input, and are used to replace other fuels or to generate electricity). Secondary steelmaking does not need that amount of energy per ton of steel, but there is not enough supply of scrap to significantly increase the share of this production method in the world total.

Steelmaking technologies have not changed fundamentally in the last decades. However the steel industry has carried out significant work to optimize production at various stages, improve energy efficiency, and reduce emissions. The result is that energy intensity has been reduced approximately by half in the last 40 years. The challenges posed by climate change

TABLE 2

Energy intensity and main raw material input ranges

TABELA 2

Energochłonność i zużycie kluczowych surowców mineralnych w procesie produkcji stali

Production route	Energy intensity [GJ/t CS[A]]	Iron ore [t/t CS[A]]	Coal [t/t CS[A]]	Limestone [t/t CS[A]]	Scrap [t/t CS[A]]
BF-OHF	26.4–41.6	–	–	–	–
BF-BOF	19.8–31.2	1.495–1.620	0.222–0.770	0.030–0.158	0.120–0.424
SR-BOF	30.4–32.1	1.490–1.780	0.630–1.200	0.006	–
DR-EAF	28.3–30.9	1.700	–	–	–
EAF	9.1–12.5	0.000–0.368	0.005–0.034	0.025–0.140	1.039–1.232[B]

[A] – crude steel; [B] – or DRI
Source: ETSAP 2010; European Commission 2011; Worldsteel 2008; Worldsteel 2011.

issues and the new environmental legislation that is coming into force (such as the emission trading schemes) is fostering research aimed at overcoming the limitations of conventional steelmaking technologies and at identifying new technologies able to produce much larger reductions in GHG emissions. Currently there are several regional research initiatives throughout the world, such as the AISI Technology Roadmap Programme in the US (http://steeltrp.com/), the Ultra-Low Carbon Dioxide Steelmaking (ULCOS) project in Europe (http://www.ulcos.org), the POSCO CO_2 Breakthrough Framework in Korea (http://www.posco.com/), or the COURSE50 programme in Japan (http://www.jisf.or.jp/). Those initiatives involve steel producers, energy suppliers, and engineering firms. The most promising results of those initiatives focus on:

— in-process CO_2 capture (by using modified BFs or smelting reduction processes),
— use of hydrogen as a reducing agent,
— use of electricity as a reducing agent,
— use of biomass to produce reducing agents,
— carbon capture and storage (CCS) (Worldsteel 2009).

2. Steel markets

2.1. Demand

Steel consumption is commonly linked to GDP per capita levels through the so-called steel intensity, which can be described as a function that, although depends on the country considered, usually follows an inverse U-shaped curve (Mannaerts 2000; van Vuuren,

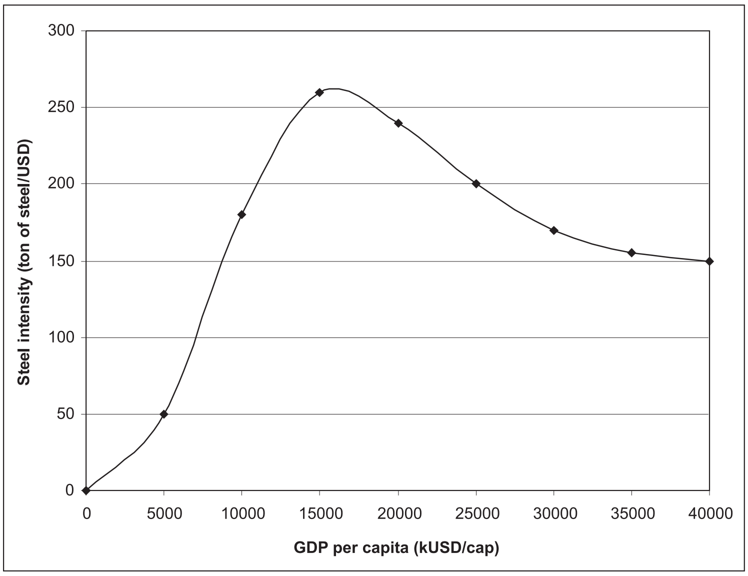

Fig. 3. Typical steel intensity curve with respect to GDP per capita

Rys. 3. Typowa krzywa konsumpcji stali w zależności od PKB na mieszkańca

Strengers, de Vries 1999). That shape can be explained by the overlapping of three different effects in the requirements of steel produced by:

— changes due to the economic transition from agriculture-manufacturing and building--services,
— changes due to substitution by competing materials,
— changes due to technological developments – developing countries would be by the left side of the curve, while developed countries would be by the peak or the right side.

Steel products are used for a wide range of applications in which there is not a suitable alternative, such as buildings and infrastructure, machinery and equipment, tools, appliances, weaponry, and ships and vehicles. Around 25% of the steel products are shipped to service centres and distributors, 22% are consumed by the construction sector, 15% by automakers and vehicle manufacturers, 3% are used for the production of packaging, and the rest (around 35%) is used mainly for other industrial applications or traded (Fenton 2005). Not only steel products have commercial applications, for instance slag is used for manufacturing asphaltic aggregates, clinker and concrete, cement additives, railroad ballast or road bases.

The world average consumption of steel products amounted to 178.9 kg per capita in 2009 (see Table 3). The consumption per capita is significantly higher in developed areas (240.7 kg in the European Union) than in developing regions (e.g. 42.1 kg in Africa).

Continuous cast steel output in 2009 was 1149.3 Mt, i.e, almost 94% of crude steel output. The difference between crude steel output and cast steel output accounts for home scrap output. By region, the highest apparent consumption (i.e., the result of adding

TABLE 3

Apparent consumption of finished steel products in 2009

TABELA 3

Wykazane zużycie wyrobów stalowych gotowych w 2009 r.

Region	Finished steel apparent consumption [Mt]	Apparent steel use per capita [kg/person]
European Union	118.4	240.7
Other Europe	23.9	209.8
Former Soviet Union	35.8	140.3
North America	80.9	178.9
Central and South America	33.6	73.9
Africa	26.4	42.1
Middle East	40.7	204.8
Asia	755.4	207.1
Australia and New Zealand	6.1	233.4
World total	1 121.2	178.9

Source: Worldsteel 2010.

production and imports and subtracting exports, without taking into account changes in stock levels) of finished steel products took place in Asia (67.37% of the world total). China's apparent consumption was 48.38% of the total. The European Union and North America were the second and third largest consumers of finished products (10.56% and 7.22% respectively).

2.2. The supply chain of steel

World crude steel production has been increasing steadily since the 70s, from 595 Mt in 1970 to 1414 Mt in 2010 (Worldsteel 2010). Geographically, crude steel production in 2009 was concentrated in Asia (comprising China, India, Japan, South Korea, Taiwan and South East Asian countries: 65.37% of the world total), and China alone accounted for 46.30% of the world total production. Other major producing areas were the European Union (11.33%), the former Soviet Union (8.03%), and North America (US, Canada, and Mexico: 6.65%). Production in developing regions was much smaller.

At the global level most crude steel is produced by primary routes (~72%), while the rest is produced by secondary steelmaking. The open hearth furnace-based production amounted only to 1.3 % (see Table 4). That technology is still used in the former Soviet Union, India, and some South East Asian countries, but it is likely to disappear due to its higher costs with respect to alternative production routes.

TABLE 4

Crude steel production by region and technology in 2009

TABELA 4

Produkcja stali surowej w 2009 r., według regionu i technologii

Region	Crude steel production [Mt]	Primary-based production [%]	Secondary-based production [%]	Other[A] [%]
European Union	138.8	55.9	43.6	0.5
Other Europe	28.2	30.6	69.4	0.0
Former Soviet Union	98.3	63.9	21.3	14.8
North America	81.4	37.8	62.2	0.0
Central and South America	38.8	61.0	39.0	0.0
Africa	15.1	33.9	66.1	0.0
Middle East	17.3	11.5	88.5	0.0
Asia	800.7	81.1	18.8	0.1
Australia and New Zealand	6.0	69.6	30.4	0.0
World total	1 224.8	70.6	28.1	1.3

[A] – This column also includes open hearth furnace-based production.
Source: Worldsteel 2010

As regards the intermediate products needed for steelmaking, pig iron production reached 909.60 Mt in 2009, while DRI production was 60.60 Mt. Global iron ore production was 2180.80 Mt in 2008 (see Table 5). Iron ore production is controlled by a few global firms. For instance, in 2003 three firms (Rio Tinto, BHP Billiton, and CVRD) accounted for almost half of the world output of iron ore and 70% of global seaborne iron trade (Nolan 2008).

Since some of the major steel producing countries are not blessed with enough domestic iron sources, there is a significant trade, mostly seaborne (Hidalgo, Calleja, Torrecilla 2007; Yellishetty, Ranjith, Tharumarajah 2010). The cases of Australia and Brazil are typical. Both countries have large deposits of iron ore and metallurgical coal although they are not major steel producers. Iron and coal are rather exported to China and Europe.

Increasing demand from metallurgical industry resulted in a significant increase in global coking coal production, from 480 Mt in 2000 to 793.8 Mt in 2008 (see Table 6), by 65%. Although China was responsible for almost half of the world coking coal production in 2008, its consumption exceeded domestic production. The second biggest coking coal producer is Australia with a yearly output of approximately 142 Mt (Ozga-Blaschke 2010).

Approximately 30% of global coking coal production is traded in the international market. The international trade increased by 40% in 2008 when compared to 2000 reaching almost 260 Mt. Because of remote location of demand regions, 90% of coking coal is shipped by sea. Due to quality requirements, hard-type coking coal is mostly traded internationally

TABLE 5

Iron ore production, trade, and apparent consumption in 2008

TABELA 5

Produkcja, eksport, import ujawniona konsumpcja rudy żelaza w 2008 r.

Region	Production [Mt]	Exports [Mt]	Imports [Mt]	Apparent consumption [Mt]
European Union	26.5	42.6	181.2	165.2
Other Europe	5.5	1.3	10.2	14.3
Former Soviet Union	188.4	62.6	16.6	142.3
North America	96.6	41.2	22.2	77.6
Central and South America	384.7	299.8	12.1	97.0
Africa	64.1	42.6	7.0	28.5
Middle East	20.0	5.4	18.4	33.1
Asia	1 042.9	110.8	659.6	1 591.6
Australia and New Zealand	352.1	309.4	4.6	47.3
World total	2 180.8	915.6	931.9	2 197.7

Source: Worldsteel 2010.

TABLE 6

Coking coal production and apparent consumption in 2008

TABELA 6

Produkcja i ujawniona konsumpcja węgla koksowego w 2008 r.

Region	Production [Mt]	Apparent consumption [Mt]
Former Soviet Union	88.3	83.6
Europe	31.2	86.3
Central and South America	0.8	13.0
North America	87.6	26.0
Africa	3.5	5.5
Australia and New Zealand	142.5	4.5
China	385.0	387.5
Other Asia	54.9	135.4
World total	793.8	741.8

Source: Ozga-Blaschke 2010.

(approx. 130–140 Mt) and the market, as in the case of iron ore, is dominated by five key producers-exporters: BHP Billiton Mitsubishi Alliance (33%), Teck Cominco (16%), Anglo American/Mitsui (8%), Xstrata (7%) and Rio Tinto (6%) (Ozga-Blaschke 2010).

The most important importers of coking coal are located in Asia. Japan, being the biggest, imported 57.4 Mt in 2008, Korea 24.1 Mt and India 28.8 Mt (see Table 8). China gradually increased coking coal imports to cover domestic demand. As concerns Europe, coking coal is imported mainly to Germany, Italy, France and the UK.

Trade figures are also remarkable for scrap, because of its sheer volume with respect to the steel production levels and the long distances involved in that trade. In 2008 world scrap exports reached 89.5 Mt, while imports were 107.7 Mt (see Table 9). The European Union

TABLE 7

Main exporters of coking coal in 2000/2008

TABELA 7

Główni eksporterzy węgla koksowego w 2000 i 2008 r.

Exporting country	2000 [Mt]	2008 [Mt]
China	6.5	0.7
Russia	7.3	12.2
Canada	28.4	21.2
USA	29.8	33.8
Australia	99.8	133.5

Source: Ozga-Blaschke 2010.

TABLE 8

Main importers of coking coal in 2000/2008

TABELA 8

Główni importerzy węgla koksowego w 2000 i 2008 r.

Importing country	2000 [Mt]	2008 [Mt]
Italy	7.2	7.5
France	6.5	7.3
UK	8.5	6.3
Germany	4.6	9.3
China	0.3	6.9
India	11.1	28.8
Korea	19.6	24.1
Japan	57.1	57.4

Source: Ozga-Blaschke 2010.

TABLE 9

Steel and scrap trade in 2008

TABELA 9

Handel stalą i złomem w 2008 r.

Region	Steel exports [Mt]	Steel imports [Mt]	Scrap exports [Mt]	Scrap imports [Mt]
European Union	155.6	162.2	42.7	39.5
Other Europe	23.1	22.4	2.2	18.9
Former Soviet Union	62.7	15.6	0.8	0.9
North America	26.0	46.8	26.8	15.0
Central and South America	13.6	13.9	0.7	0.4
Africa	0.0	20.3	4.6	2.7
eepnMiddle East	9.5	40.2	0.3	0.0
Asia	140.4	107.9	7.9	29.1
Australia and New Zealand	1.8	87.8	2.0	0.0
World total	432.7	432.7	89.5	107.7

Souce: Worldsteel 2010.

and Asia are the major importers of scrap. The European Union was also the major supplier, followed by the US. Steel scrap is an outstanding example of recycling via market, especially in the US. The scrap processing industry is global, and prices are determined by demand and supply in world markets. The supply of new scrap is a function of industrial activity, and thus whenever the activity is high more industrial scrap is generated. Scrap prices affect the prices of iron ore, pig iron, and DRI. World prices are set in the US, which is the largest open scrap market. There is no futures market for scrap. Scrap prices experience seasonal changes, tending to rise significantly in winter, while falling in spring and summer. Prices are influenced by the demand for steel, and also by transport costs (especially shipping). The scrap industry uses inventories to absorb price differentials. The scrap industry consists of collectors and small dealers, large dealers and processors, and brokers. Collectors and small dealers generally handle all types of recyclable scrap, and the large dealers and processors specialize in iron and steel scrap, nonferrous metals, waste paper, and so forth (Fenton 2005). There is no clear pattern of consolidation or globalization in the global scrap industry. A few large firms are able to operate globally, but there are many small firms in almost every country. Even the leading suppliers are price takers, and the industry seems to be rather competitive (Aylen, Albertson 2006).

Steel products are also traded significantly, and exports have almost trebled since the 70s. In 1975, 22.6% of the global steel production (that is, 114.7 Mt) was exported. In 2008 exports amounted to 436.2 Mt, 34.9% of the world production. There are significant trade imbalances in some regions, especially in the former Soviet Union, North America, Africa, the Middle East, and Australia and New Zealand. At the country level, the highest imbalances are found in China (15.6 Mt of imports versus 56.3 Mt of exports) and Japan (4.5 Mt of imports, 36.9 Mt of exports).

2.3. Prices and costs

Steel prices depend on several variables, and there is not a single price for steel since there is a great variety of steel products. The technology choice for steelmaking is a key determinant of the price. Table 10 shows the ranges of different costs categories by technology.

TABLE 10

Estimated cost ranges in 2010 (USD2000)

TABELA 10

Oszacowanie zakresu kosztów produkcji stali 2010 r. (USD2000)

Production route	Investment costs [USD/t of hot metal]	Fixed O&M costs [USD/t of hot metal]	Variable O&M costs[A] [USD/t of hot metal]
BF-OHF	–	–	–
BF-BOF	148–275	10–15	90
SR-BOF	98–320	10–15	13–19
DR-EAF	142	–	–
EAF	80	–	–

[A] – input costs not included.
Source: ETSAP 2010.

The previous table does not consider the prices of inputs. Those prices depend on supply and demand interaction (between steelmakers and consumers, but also on interaction with other industries competing for the same inputs), and on transport conditions. Table 11 shows a selection of prices of different inputs, as well as some prices of finished products.

The raw material and energy costs of steel production are strongly interrelated, and closely linked with other technological variables and firm's know-how. For instance, availability of iron ores of appropriate quality has a significant impact on energy and material efficiencies. Iron ores used in China were in general of inferior grade (with an average iron content of 34%) and the steel produced in China had high coke rates and high iron-to-steel efficiency. On the other hand, in the 70s and 80s, Japanese steelmakers signed long-term contracts ensuring supplies of high-quality ores from Brazil and Australia. Afterwards, the price of ore decreased to the point where Japanese firms could secure ores at prices well below the cost incurred by other companies, even taking into account the shipping costs.

This led to increments in market shares and profits of the Japanese companies, which also led to further investments and technological improvements. Technology improvements are also triggered by increasing energy prices, in an effort to improve energy efficiency and reduce

TABLE 11

Prices of selected energy inputs, raw materials, and finished steel products

TABELA 11

Ceny wybranych nośników energii, surowców mineralnych i produktów stalowych gotowych

	Commodity	Unit	2000	2005	2010
Energy inputs	coal (Australia)[A]	USD 2000/t	26.25	43.24	82.06
	natural gas (US)[B]	USD 2000/GJ	4.09	7.68	3.45
	natural gas (EU)[C]	USD 2000/GJ	3.66	5.44	6.51
	natural gas (Japan)[D]	USD 2000/GJ	4.46	5.16	8.53
Materials	iron ore (fob)[E]	1/100·USD 2000/dmtu[N]	28.79	59.02	n.a.
	iron ore (cfr spot)[F]	USD 2000/dmtu[N]	n.a.	n.a.	120.95
	iron ore (US)[G]	USD 1998	24.40	36.60	n.a.
	scrap (US)[H]	USD 1998	90.00	n.a.	n.a.
	lime (US)[I]	USD 1998	59.40	79.80	n.a.
Finished steel products	cold-rolled coil/sheet[J]	USD 2000/t	385.83	665.84	676.33
	hot-rolled coil/sheet[K]	USD 2000/t	295.83	575.05	593.41
	rebar[L]	USD 2000/t	244.17	384.18	466.44
	wire rod[M]	USD 2000/t	291.67	525.86	590.58

[A] – Thermal coal, fob, shipped from Newcastle-Port Kembla (World Bank Commodity Markets).
[B] – Spot price at Henry Hub, Lousiana (World Bank Commodity Markets).
[C] – Average import border price (World Bank Commodity Markets).
[D] – LNG import price, cif (World Bank Commodity Markets).
[E] – Brazilian iron ore, dmtu: dry metric ton of 1% Fe (World Bank Commodity Markets)
[F] – Iron ore (any origin) fines, spot price, cfr China, 62% Fe (World Bank Commodity Markets).
[G] – Average composite price per metric ton of steel apparent consumption (USGS).
[H] – US No. 1 Heavy Melting Scrap
[I] – Average composite price per metric ton of steel apparent consumption (USGS).
[J] – Cold-rolled coil/sheet (Japan) producers' export contracts fob mainly to Asia (World Bank Commodity Markets).
[K] – Hot-rolled coil/sheet (Japan) producers' export contracts (3 to 12 months terms) fob mainly to Asia
[L] – Rebar (Japan) producers' export contracts fob mainly to Asia (World Bank Commodity Markets).
[M] – Wire rod (Japan) producers' export contracts fob mainly to Asia (World Bank Commodity Markets).
[N] – Dry Metric Ton Unit (dmtu) is the internationally agreed-upon unit of measure for iron ore pricing. It has the same mass value as a metric ton, but the material has been dried to decrease the moisture level. A dry metric ton unit consists of 1% of iron (Fe) contained in a ton of ore, excluding moisture. The price per ton of a certain quantity of iron ore is calculated by multiplying the cents/dmtu price by the percentage of iron content. Iron ore contracts are quoted in US Cents.

releases, although the impact of this driving factor tends to be overestimated. Energy prices do not cause a significant change in the diffusion of integrated factories or mini-mills, since that is also highly influenced by other factors such as the availability of scrap. Other determinants are related with prices and quality of reducing agents. For instance, in the US iron and steel industry, higher coke prices are perceived as the main driver behind the introduction of BOF and the early deployment of EAF.

Further impact on the process of technology selection and energy efficiency is potentially foreseen to come from investments in more diversified and reliable energy system, demand side management, and technology-related investments. As an example, improvements in natural gas infrastructure and technology, power recovery, and direct coal injection significantly increased energy efficiency of the Chinese steel sector. Also improvements in mini-mills' electricity consumption shows energy-related advantages of mini-mills.

2.4. Consolidation of the steelmaking firms

World-wide consolidation of steelmaking firms has been taking place since the 70s in order to improve economies of scale, and also in order to reduce overcapacity (Fenton 2005). During the 30s and 40s steelmaking was regarded as a strategic industry and was state--protected. Many countries had a state-owned company dominating the domestic market. Until the 70s the steel industry obtained sustained profits that led to a stable growth. The economic recession of the 70s resulted in overcapacity and pessimistic forecasts of future demand for steel products. As a consequence, state-owned steelmakers began to be privatized; while most producers reorganized their operations in an attempt to achieve higher profitability. This process was led mostly by European and Japanese companies, and US steelmakers lagged behind. Companies made up of integrated mills and producing small outputs, or facing competition with the cheaper mini-mills, began to be shut down or sold to other firms. From 1995 to 2005 the world steel industry entered a period of intense merger and acquisition. In 1995 the top ten producers supplied ~20% of the global steel output. The surviving companies after this consolidation process were far bigger than those existing at the beginning and by 2005 their total share in world steel output reached ~29%.

With the consolidation of the industry technological changes needed larger investments, as efficiency improvements (not related with increased economies of scale) slowed down. That, and the lack of profits and access to capital, reduced the rate of technological change. The situation was worsened by failures to anticipate changes consumer needs and cost saving potentials of new technologies (Ayres et al. 2004).

Table 12 illustrates the recent consolidation process experienced by the steelmaking industry. In 2001 Arcelor (resulting from the merger of the three largest European steelmakers: the French Usinor, the Luxembourg-based Arbed, and the Spanish Aceralia) overtook Nippon Steel and became the world largest producer. The Mittal Steel Company: company began operations in 1976 under the name Ispat. Since then it followed a strategy based on the acquisition of under-performing steel mills around the world. In 1998 it

TABLE 12

Steel firm's rank and output (1995–2004)

TABELA 12

Ranking i wielkość produkcji największych producentów stali (1995–2004)

Rank	1995		1998		2002		2004	
	Firm	Output [Mt]	Firm	Output [Mt]	Firm	Output [Mt]	Firm	Output [Mt]
1	Nippon	27.8	Posco	25.6	Arcelor	44.0	Mittal	57.0
2	Posco	23.4	Nippon	25.1	LNM Group	34.8	Arcelor	43.0
3	British Steel	15.7	Arbed	20.1	Nippon	29.8	Posco	32.0
4	Usinor	15.5	Usinor	18.9	JFE	28.9	Nippon	32.0
5	Riva Group	14.4	LNM Group	17.1	Posco	28.1	JFE	30.0
6	US Steel	12.1	British Steel	16.3	Baosteel	19.5	Nucor	20.0
7	NKK	12.0	Thyssen Krupp	14.8	Corus	16.8	US Steel	20.0
8	Arbed	11.5	Riva Group	13.3	Thyssen Krupp	16.4	Thyssen Krupp	20.0
9	Kawasaki	11.1	NKK	11.5	US Steel	14.4	Baosteel	20.0
10	Sumitomo	10.7	USX	11.0	Nucor	12.4	Corus	19.0

Source: Nolan 2008.

acquired the 6th largest steelmaker in the US. After 2000 it acquired several companies in Central and Eastern Europe. In 2004 it acquired the US-based International Steel Company, and the resulting firm was renamed the Mittal Steel Company. By 2007 it merged with Arcelor becoming ArcelorMittal. But those were not the only mergers. JFE resulted from the merger in 2003 of the Japanese NKK and Kawasaki. The US-based Nucor resulted from the merger of BHP (Australia), Trico (US), and Birmingham (US) in 2002–2003. US Steel acquired National Steel (also US-based) in 2003. In China, Baosteel was formed in 1998 from the absorption of Shanghai Metallurgy Holdings and the Meishan Group by the Baoshan Iron and Steel Corporation. In the EU Thyssen and Krupp became Thyssen-Krupp in 1999, the same year British Steel (UK) merged with Hoogovens (NL) forming Corus, which was acquired by India's Tata Steel in 2007 (Nolan 2008).

As a measure of production concentration, the Herfindahl-Hirschman Index (HHI) was applied in this study, defined as the sum of the squares of the market shares of N producers. If the value is below 0.01 the market is supposed to be highly competitive. Below 0.15, the market would not be concentrated. Values between 0.15 and 0.25 indicate moderate concentration. Higher values would imply high concentration, suitable for exerting market power (Rhoades 1993).

In 2009, almost 50% of the world production (1227 Mt) was provided by the 49 firms listed in Table 13, which provides production levels and country of domicile. A calculation of

TABLE 13

Top producers (only members of WorldSteel; with crude steel production over 3 Mt) in 2009

TABELA 13

Ranking producentów stali (członkowie WorldSteel, wielkość produkcji powyżej 3 Mt) w 2009 r.

Rank	Company	Production [Mt]	HQ country	Rank	Company	Production [Mt]	HQ country
1	Arcelor Mittal	77.5	Luxembourg	26	Hyundai	8.4	South Korea
2	Baosteel	31.3	China	27	CEL SA	7.8	Spain
3	POSCO	31.1	South Korea	28	Metinvest	7.4	Russia
4	Nippon Steel	26.5	Japan	29	Techint	6.9	Italy
5	JFE	25.8	Japan	30	Erdemir	6.5	Turkey
6	Jingsu Shagang	20.5	China	31	Metalloinvest	6.5	Russia
7	Tata Steel	20.5	India	32	Kobe	5.9	Japan
8	Ansteel	20.1	China	33	Usiminas	5.6	Brazil
9	Severstal	16.7	Russia	34	JSW	5.5	India
10	Evraz	15.3	Russia	35	Essar	5.5	India
11	U.S. Steel	15.2	US	36	Voestalpine	5.5	Austria
12	Shougang	15.1	China	37	Salzgitter	4.9	Germany
13	Gerdau	14.2	Brazil	38	Hadeed	4.8	Saudi Arabia
14	Nucor	14.0	US	39	BlueScope	4.6	Australia
15	Wuhan	13.7	China	40	CSN	4.4	Brazil
16	SAIL	13.5	India	41	Ezz	3.9	Egypt
17	Handan	12.0	China	42	SSAB	3.6	Sweden
18	Riva	11.3	Italy	43	Sidor	3.1	Venezuela
19	Sumitomo	11.0	Japan	44	Duferco	3.1	Belgium
20	ThyssenKrupp	11.0	Germany	45	Nisshin	3.1	Japan
21	Novolipetsk	10.9	Russia	46	Vizag	3.1	India
22	IMIDRO	10.6	Iran	47	CMC	3.1	US
23	Magnitogorsk	9.6	Russia	48	AHMSA	3.1	Mexico
24	China Steel	8.9	Taiwan	49	Dongkuk	3.1	Korea
25	Laiwu	8.9	China		Others[A]	<3.1	

[A] – This includes the rest of the production up to 1227 Mt, that is 643 Mt. Assuming that the production of each of those producers is lower than 3 Mt per year, there would be at least 215 steel makers more.

the country-based HHI using the country shares in global crude steel production (not provided in the document) yields a value of 0.23, which shows that the steel industry is moderately concentrated, but very close to a high concentration level. If the index takes into account production by the steelmaking firms listed in Table 13, the HHI obtained is 0.01, which indicates a non-concentrated market. These disagreeing results prove the need for further research in order to provide useful insights into the developments of such an important economic sector, and especially into the consequences of the recent world-wide consolidation trends observed in the last years.

3. Concluding remarks

The iron and steel industry is a very complex sector which is intrinsically linked with the rest of the world economy. Steelmaking is highly material and energy-intensive, which combined with the unequal geographical distribution of resources needed for manufacturing steel products and meeting final demand gives rise to significant trade flows. All those factors have a particular impact on supply and demand patterns, and on prices.

There are two basic production methods that account for most of the production: (i) primary steelmaking (~72% of the global production) and (ii) secondary steelmaking (~28% of the global production). The first route requires the consumption of iron ore, coal, limestone, and scrap, plus the use of large facilities, while the second may rely on the use of scrap and electricity in smaller factories. Most steelmaking routes are energy-intensive and highly dependent on the use of solid fossil fuels. In 2006 world final energy consumption in the iron and steel industries amounted to 4.76% of global final energy consumption. Steelmaking is also a major source of greenhouse gas (GHG) emissions and air pollution. Global direct CO_2 emissions from final energy consumption in the iron and steel industry amounted to in 2006 to 3.70% of total CO_2 emissions from fuel combustion. Thus, steelmaking is one of the industrial sectors most affected by the current efforts to fight global climate change (such as the European emission trading scheme).

Steel consumption is commonly linked to GDP per capita levels through the so-called steel intensity, which can be described as a function that, although depends on the country considered, usually follows an inverse U-shaped curve. Continuously cast steel output in 2009 was 1149.3 Mt. Most of the consumption was absorbed by Asia (China), the European Union and the US. World crude steel production has been increasing steadily since the 70s, from 595 Mt in 1970 to 1414 Mt in 2010.

In order to meet the demand of finished products, steelmakers need a steady supply of raw materials (mainly iron ore, coking coal and scrap), whose production is usually controlled by a few key producers (except in the case of scrap), and requires significant trade flows. Steel products are also traded significantly, and exports have almost trebled since the 70s. As in the case of raw materials, there are remarkable trade imbalances in some regions.

Steel prices depend on several variables, and there is not a single price for steel since there is a multitude of steel products. Those prices depend on supply and demand interaction (between steelmakers and consumers, but also on interaction with other industries competing for the same inputs), and on transport conditions. The raw material and energy costs of steel production are strongly interrelated, and closely linked with other technological variables and firm's know-how.

World-wide consolidation of steelmaking firms has been taking place since the 70s in order to improve economies of scale, and also in order to reduce overcapacity. The current steel industry is made up of some large firms that operate globally and produce a significant output, and many small firms that operate at a smaller scale. The industry has been the subject of oligopolistic analyses since the 50s to date (not to mention the countless engineering-related studies). However, despite the historical consolidation trends towards multinational companies, rather than being world-wide those analyses focus on specific countries and regions. On the other hand most analyses also expect that the industry will reach higher levels of consolidation in the forthcoming years. Therefore, any future mid or long term analysis of the steel industry should take into account that trend and the global nature of the sector. Moreover, given the complexity of all the relationships outlined previously, exclusive reliance on expert analysis does not seem to guarantee the gaining of a proper and comprehensive insight into the prospects of this key economic sector. The main conclusion of this overview is that any future analysis of the iron and steel industry should be based on quantitative modelling tools that: (i) properly capture the technological diversity of the industry and the key features of the supply chain, (ii) are able to consider the strategic behaviour of all the key players of the industry, and (iii) consider all those factors at the global scale.

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PRZEMYSŁ ŻELAZA I STALI: ANALIZA STANU OBECNEGO Z PERSPEKTYWY RYNKU ŚWIATOWEGO

Słowa kluczowe

Przemysł żelaza i stali, rynek międzynarodowy, surowce mineralne, konsolidacja, siła rynkowa

Streszczenie

W artykule przedstawiono stan obecny rozwoju technologii wykorzystywanych w hutnictwie żelaza i stali z punktu widzenia rynku światowego. Sektor produkcji żelaza i stali charakteryzuje się bardzo skomplikowanymi zależnościami, ze względu na silne powiązanie z resztą gospodarki oraz znaczenie wyrobów stalowych dla innych sektorów przemysłowych, takich jak na przykład budownictwo, motoryzacja itp. Ponadto, hutnictwo żelaza i stali wymaga znacznych ilości surowców mineralnych i energii, a większość firm produkujących surowce mineralne jest zlokalizowanych z dala od obszarów o najwyższym popycie na stal. W konsekwencji, zarówno wyroby stalowe jak i surowce mineralne są przedmiotem handlu międzynarodowego (głównie drogą morską), co dodatkowo utrudnia prowadzenie analiz dotyczących sektora hutnictwa żelaza i stali. Ceny stali, a w zasadzie poszczególnych wyrobów stalowych, które są przedmiotem obrotu, zależą od wielu czynników. Do najważniejszych z nich należą przede wszystkim zgłaszany przez konsumentów popyt, zdolności produkcyjne oraz aktualna sytuacja w międzynarodowym transporcie.

Jeśli chodzi o strukturę własności, w przemyśle stalowym funkcjonuje kilka dużych firm, które mają swoje huty w całym świecie (często zakupione w procesie prywatyzacji lub w wyniku fuzji z innymi przedsiębiorstwami) oraz wiele małych firm, które działają na znacznie mniejszą skalę. W ostatnim czasie niektóre firmy przeszły proces konsolidacji i fuzji w wyniku czego powstały koncerny międzynarodowe (takie jak ArcelorMittal, który powstał w 2006 roku w wyniku fuzji Arcelora i Mittal Steel; Arcelor powstał z kolei w wyniku połączenia Aceralia (Hiszpania), Usinor (Francja) i Arbed (Luksemburg) w 2002 r.).

Wyniki analizy zaprezentowanej w niniejszym artykule stanowią podstawę do dalszych badań w zakresie długo- i średniookresowych perspektyw rozwoju światowego przemysłu stalowego. Analizy w zakresie rozwoju przemysłu żelaza i stali powinny być oparte na narzędziach ilościowych (modele matematyczne) które umożliwiają: (i) właściwe uchwycenie różnorodności technologicznej przemysłu i głównych cech łańcucha dostaw surowców mineralnych i energii, (ii) odzwierciedlenie różnych strategii przyjmowanych przez poszczególnych kluczowych graczy w branży oraz (iii) wzięcie pod uwagę wszystkich wspomnianych czynników na poziomie rynku międzynarodowego.

Key words

Iron and steel industry, international market, raw materials, consolidation, market power

Abstract

The paper presents a global perspective of the current technologies used for steel production and the steel markets. The iron and steel industry is a very complex sector that is strongly related with the rest of the economy due to the importance of steel products for industries such as construction, automotive, and other manufacturing sectors. Moreover, the iron and steel industry demands significant amounts of raw materials and energy, and most companies producing raw materials are located remote from the areas of highest steel demand. In consequence, both steel products and inputs are traded internationally (mostly by sea) and in large quantities, what additionally complicates analyses of the iron and steel industry. Steel prices depend on several variables, and there is not a single price for steel since there is a great variety of steel products traded. Those prices depend on supply and demand interaction (between steel producers and consumers, but also on interaction with other industries competing for the same inputs), and on transport conditions.

As concerns the ownership structure, the steel industry consists of some large firms that operate globally and produce significant output, and many small firms that operate at a lesser scale. Recently, some of those firms have consolidated into large multinationals (such as ArcelorMittal, formed in 2006 by the merger of Arcelor and Mittal Steel, Arcelor being the result of the previous merger of Aceralia (ES), Usinor (FR), and Arbed (LX) in 2002).

The results of this article form the basis for further long- and mid-term analyses of the development of the global steel industry. The main conclusion of the paper is that any future analysis of the iron and steel industry should be based on quantitative modelling tools that: (i) properly capture the technological diversity of the industry and the key features of the supply chain, (ii) are able to consider the strategic behaviour of all the key players of the industry, and (iii) consider all those factors at the global scale.