中国钢铁工业协会
CHINA IRON & STEEL ASSOCIATION

中国钢铁工业绿色低碳发展愿景与实践

Vision and Practice of Green and Low- Carbon Development for the Chinese Steel Industry

报 告 人：李煜

中国钢铁工业协会科技环保部副主任

Presented by Li Yu

Vice Director General of Sci-tech and Environmental Protection Dept.

CISA

Better Steel
Better World

目　录/Content

一、中国政府碳达峰碳中和有关政策
Policies of the Chinese Government on Carbon Peak and Carbon Neutrality

- **气候变化是人类共同面临一个重大挑战，威胁着人类健康与发展。近年来，国际社会探索构建以《联合国气候变化框架公约》《京都议定书》《巴黎协定》及相关附件为制度框架的全球气候治理体系。**

Climate change is a major challenge faced by humanity, threatening human health and development. In recent years, the international community has explored the establishment of a global climate governance system with the United Nations Framework Convention on Climate Change, Kyoto Protocol, Paris Agreement and related annexes as the institutional framework.

- **中国将提高国家自主贡献力度，采取更加有力的政策和措施，二氧化碳排放力争于2030年前达到峰值，努力争取2060年前实现碳中和。 ——习近平主席 第75界联合国大会一般性辩论，2020年9月22日**

China will enhance its nationally determined contribution (NDC), adopt stronger policies and measures, and strive to peak carbon dioxide emissions by 2030, and achieve carbon neutrality by 2060. —— PresidentXi Jinping
General Debate of the 75th United Nations General Assembly, September 22, 2020

- **中国国家主席习近平通过联合国气候变化峰会宣布了中国新一轮国家自主贡献（NDC）目标：到2035年，全经济范围温室气体净排放量比峰值下降7%至10%，非化石能源消费占比达到30%以上，风电和太阳能装机容量达到2020年的6倍以上。**

President Xi Jinping announced China's new Nationally Determined Contributions (NDC) targets via video speech at the United Nations Climate Change Summit: By 2035, the net emissions of greenhouse gases across the entire economy will decrease by 7% to 10% compared to the peak level, the share of non-fossil energy consumption will reach over 30%, and the installed capacity of wind and solar power will reach more than six times the 2020 level.

一、中国政府碳达峰碳中和有关政策
Policies of the Chinese Government on Carbon Peak and Carbon Neutrality

形成“1+N”双碳政策体系
The national level "1+N" policy framework for carbon peaking and carbon neutrality has been basically formed.

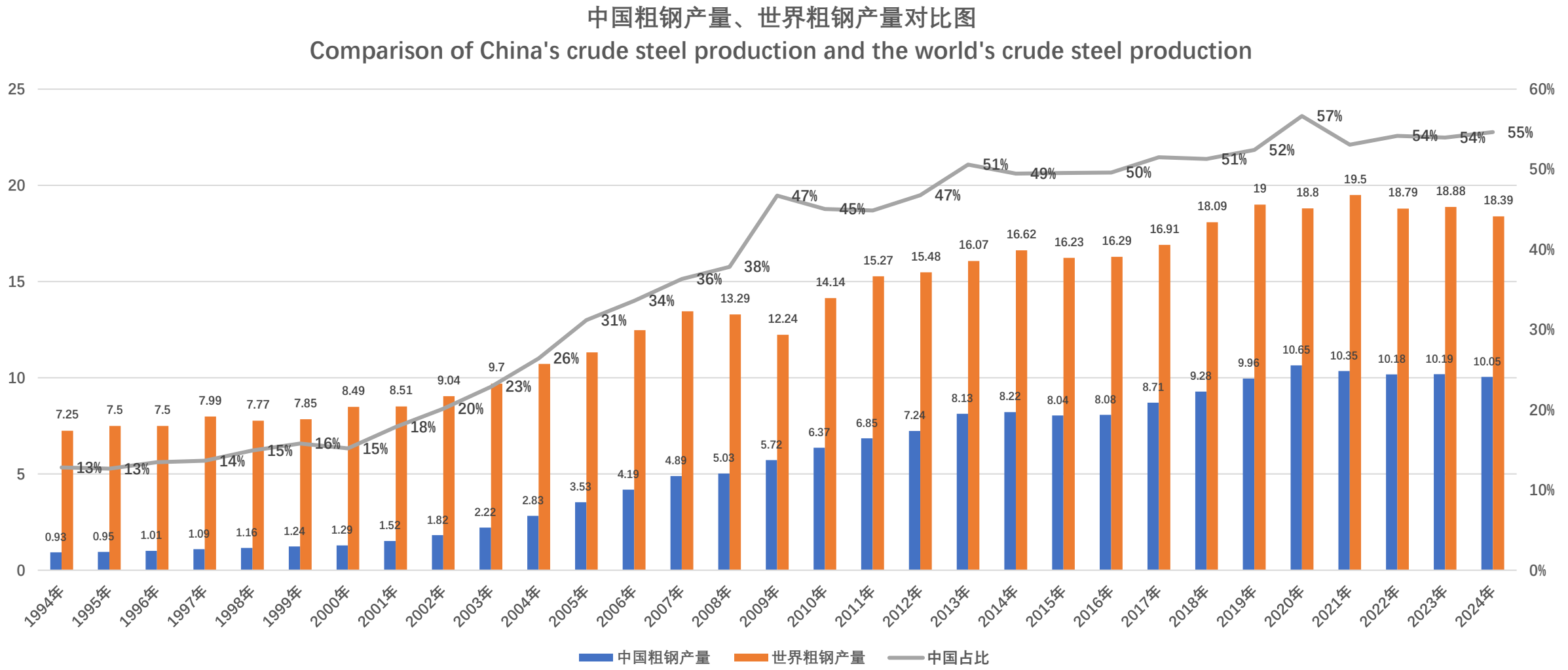
1+N"顶层设计 “1+N” policy documents		发布日期
1	关于完整准确全面贯彻新发展理念做好碳达峰碳中和工作的意见 Opinions on the Complete and Accurate Implementation of the New Development Philosophy and Doing a Good Job in Carbon Peak and Carbon Neutrality	2021-10
2	2030年前碳达峰行动方案 The Action Plan for Carbon Dioxide Peak Before 2030	2021-10
重点领域重点行业实施方案Implementation plans for key areas and key industries		
1	减污降碳协同增效实施方案 Implementation plan of pollution and carbon emissions collaborative reduction	2022-06
2	农业农村减排固碳实施方案 Implementation plan for emission reduction and carbon sequestration in agriculture and rural areas	2022-06
3	城乡建设领域碳达峰实施方案 Implementation plan for carbon peaking in urban and rural construction	2022-07
4	工业领域碳达峰实施方案 Implementation for carbon peaking in industry sector	2022-08
5	建材行业碳达峰实施方案方案 Implementation plan for carbon peaking in building materials industry	2022-11
6	有色金属行业碳达峰实施方案 Implementation plan for carbon peaking Non-ferrous metal	2022-11
重要支撑保障方案 Important support and guarantee schemes		
1	促进绿色消费实施方案 Implementation plan for promoting green consumption	2022-01
2	关于完善能源绿色低碳转型体制机制和政策措施的意见 Opinions on improving the systems, mechanisms, policies and measures for green and low-carbon energy transformation	2022-01
3	财政支持做好碳达峰碳中和工作的意见 Opinions on financial support for carbon peak and carbon neutrality	2022-05
4	科技支撑碳达峰碳中和实施方案（2022—2030年） Implementation plan for carbon peaking and carbon neutrality supported by science and technology (2022-2030)	2022-08
5	关于加快建立统一规范的碳排放统计核算体系实施方案 Implementation plan on accelerating the establishment of a unified and standardized carbon emission statistical accounting system	2022-08
6	建立健全碳达峰碳中和标准计量体系实施方案 Implementation plan for establish and improve standard measurement system for carbon peak and carbon neutrality	2022-10
7	绿色低碳发展国民教育体系建设实施方案 Implementation plan for building a national education system for green and low-carbon development	2022-11

- **自2020年9月“双碳”目标明确以来，国家级顶层设计文件陆续出台，“1+N”政策支撑体系脉络基本清晰。相关文件从严控产能、减量置换、结构调整、能效提升、能源结构调整、清洁生产等多方面，对钢铁行业绿色低碳高质量发展均提出了明确要求，为行业低碳转型指明了方向。**
- Since the " Carbon Peaking and Carbon Neutrality" goal was clarified in September 2020, national top-level design documents have been issued, and the "1+N" policy system is basically clear. Relevant documents have put forward stricter requirements for green, low-carbon, high-quality development of the iron and steel industry from capacity control ,reduction and replacement, process adjustment, energy efficiency improvement, energy structure adjustment, clean production and other aspects, pointing out the direction for the low-carbon transformation of the industry.

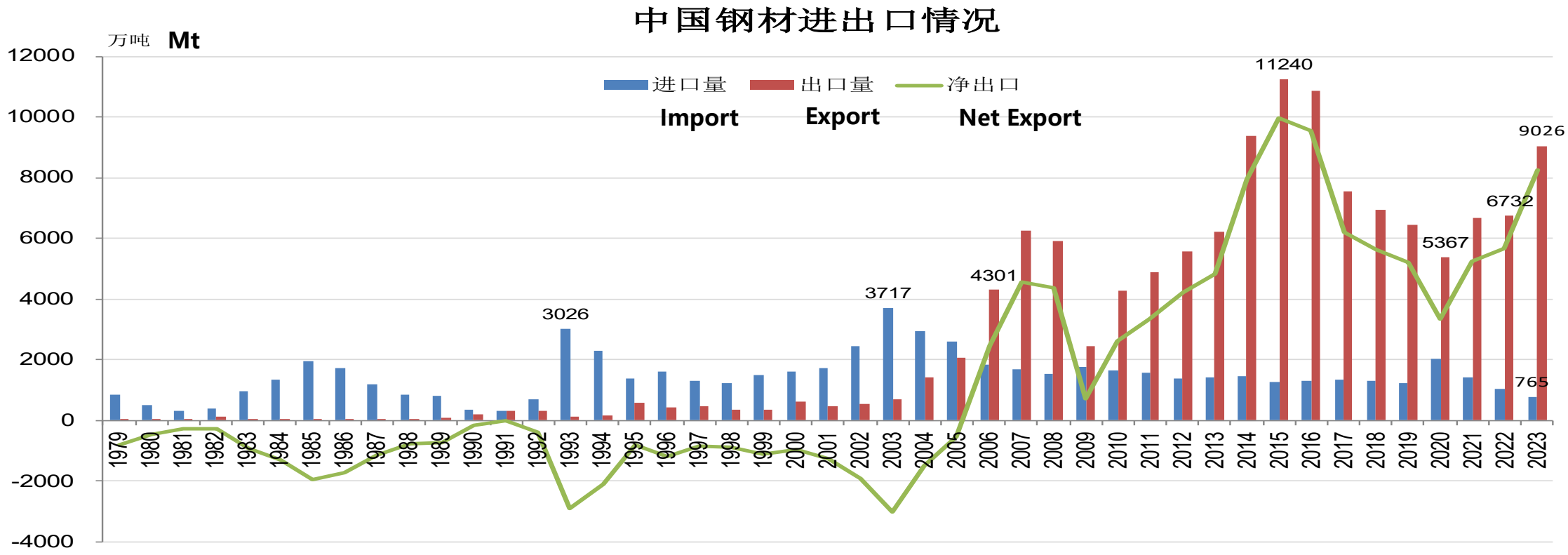
目　录/Content

二、中国钢铁低碳发展愿景
Low-carbon Development Vision of Chinese Steel Industry

- **中国钢铁工业顺应经济全球化大潮，实现快速发展，2017年开始粗钢产量占世界50%以上。**
- **China's steel industry has followed the trend of economic globalization and achieved rapid development. Since 2017, crude steel production has accounted for more than 50% of the world's total.**



中国钢铁进出口情况 Import and Export Situation of Chinese Steel Industry



- **中国钢铁工业发展与中国经济增长相辅相成，出口比例低于10%以下，中国钢铁生产以满足国内需求为主。**
- **中国长期进口钢材，直到2006年才成为钢材净出口国，到2014年钢材累计出口量首次超过累计进口量。**

China's steel industry has developed in tandem with the country's economic growth, with exports accounting for less than 10% of output.

China did not become a net steel exporter until 2006.In 2014 the cumulative steel exports exceeded the cumulative imports for the first time.

二、中国钢铁低碳发展愿景
Low-carbon Development Vision of Chinese Steel Industry

- **中国钢铁工业以满足国内需求为主，支撑了本国经济发展和人民生活质量提升。**
- **Mainly meeting the domestic demand, the Chinese steel industry has supported the country's economic development and the improvement of people's livelihood.**






120000
100000
80000
60000
40000
20000
0

20
18
16
14
12
10
8
6
4
2
0

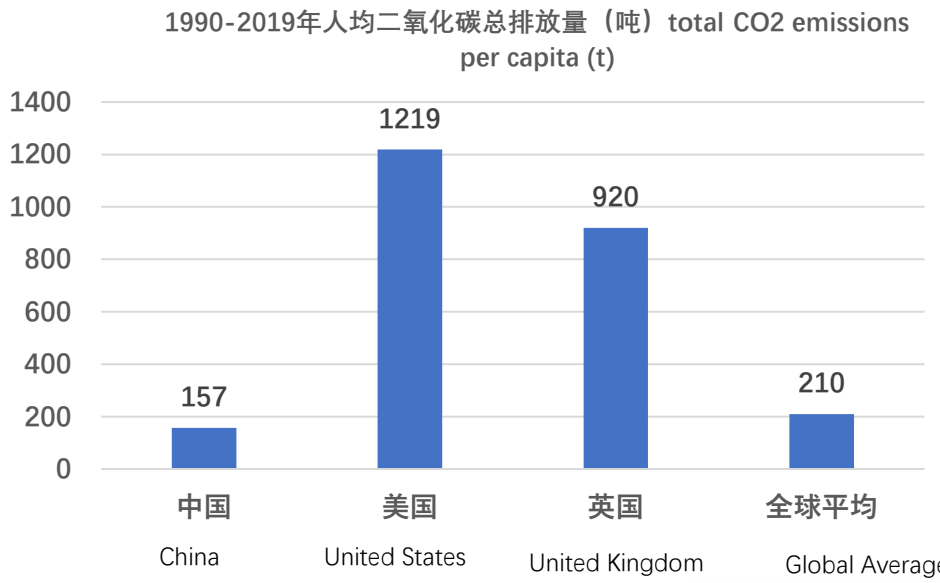
1949 1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022

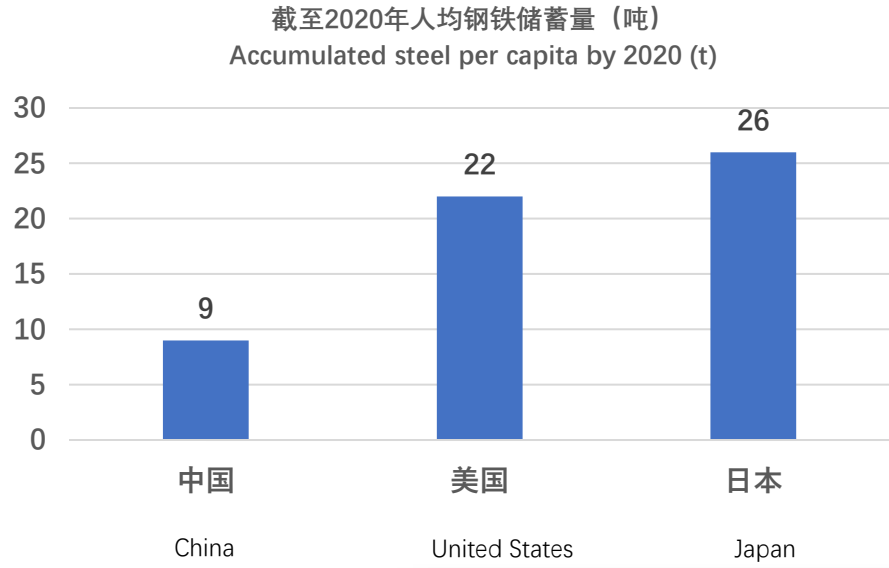
粗钢产量（万吨）
Crude Steel Production (Mt)

GDP（万亿美元）（现价美元）
(Trillions of U.S dollars)

二、中国钢铁低碳发展愿景
Low-carbon Development Vision of Chinese Steel Industry

China will maintain a certain scale of steel products to meet the needs of economic development and the improvement of citizen's living standards.





- 2004年第三产业从业人数占比31%

In 2004, the proportion of employees in the tertiary industry was 31%.

- 2019年第三产业从业人数占比47%

In 2019, the proportion of employees in the tertiary industry was 47%.

- 2023年第三产业从业人数占比48%

In 2023, the proportion of employees in the tertiary industry was 48%.

- 数据来源：国家统计局

Source: National Bureau of Statistics of China

- 1940年第三产业从业人数占比44%

In 1940, the proportion of employees in the tertiary industry was 44%.

- 1990年第三产业从业人数占比72%

In 1990, the proportion of employees in the tertiary industry was 72%.

- 2001年第三产业从业人数占比79%

In 2001, the proportion of employees in the tertiary industry was 79%.

- 数据来源：美国劳工部

Source: U.S. Department of Labor.

- 1955年第三产业从业人数占比34%

In 1955, the proportion of employees in the tertiary industry was 34%

- 1970年第三产业从业人数占比45%

In 1970, the proportion of employees in the tertiary industry was 45%

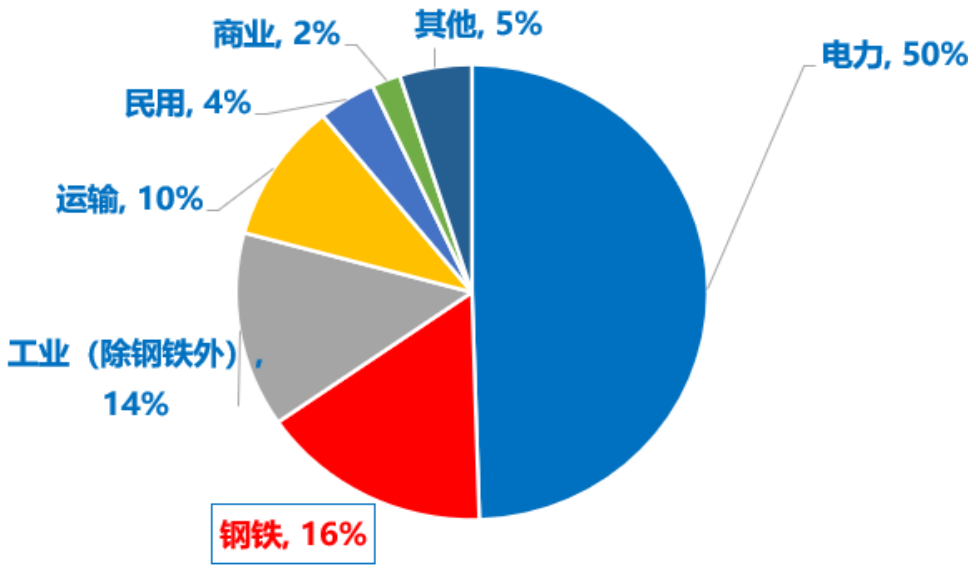
- 2000年第三产业从业人数占比64%

In 2000, the proportion of employees in the tertiary industry was 64%

- 数据来源：《日本国民经济年认底》

Source: Annual Report on National Accounts of Japan

二、中国钢铁低碳发展愿景
Low-carbon Development Vision of Chinese Steel Industry

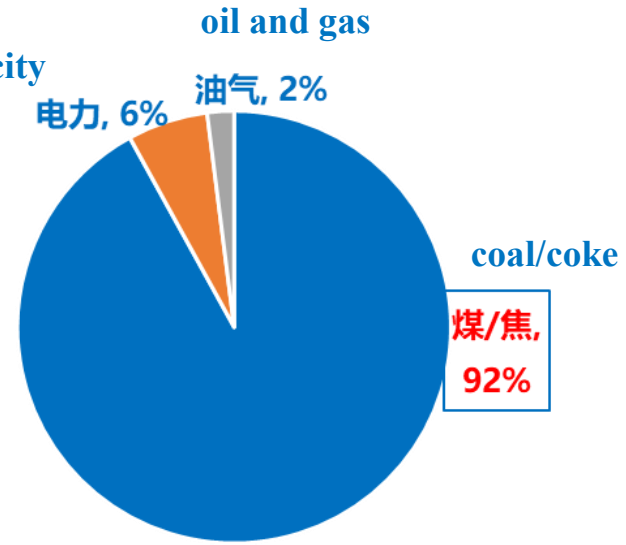


碳排放量占中国总排放量16%
The Carbon emissions of China steel and iron industry occupy 16% of China total Carbon emissions

*数据来自世界钢协发布的《2021年世界钢铁统计数据》、《中国工业新闻网》

能源结构

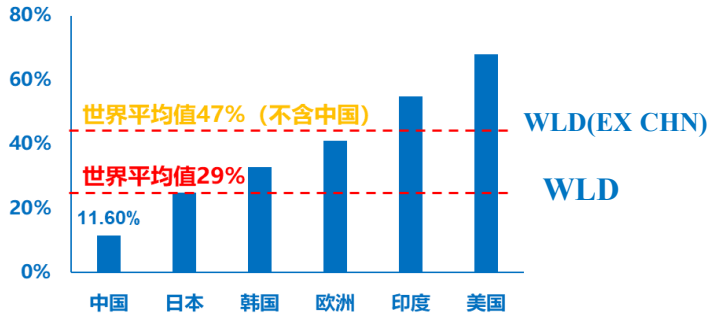
钢铁行业煤、焦炭占能源投入的90%以上，对化石能源的高度依赖是钢铁行业大量碳排放的根源所在。



中国钢铁工业能源结构
Energy Structure

流程结构

高炉-转炉长流程占主导，占粗钢产量90%以上，电炉钢比偏低。

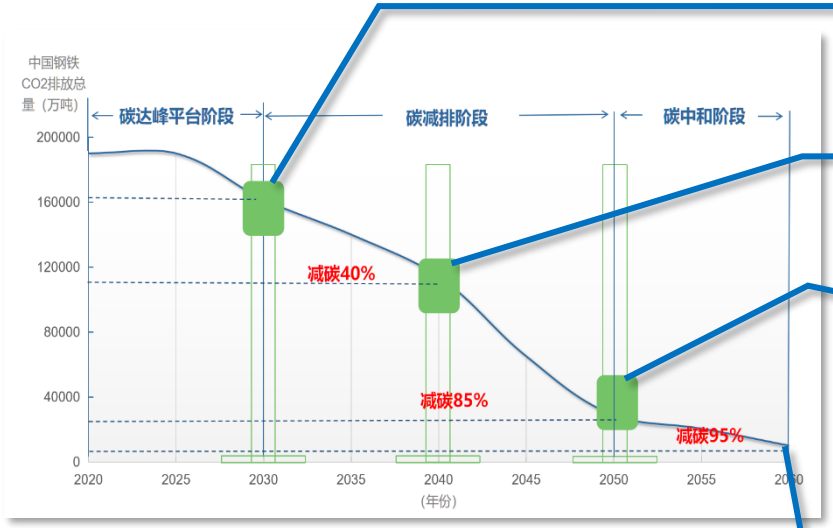


世界各国电炉钢占比
（Proportion of EAF ）
Process Strcuture

二、中国钢铁低碳发展愿景
Low-carbon Development Vision of Chinese Steel Industry

中国钢铁工业400余名专家开展了钢铁行业碳达峰碳中和愿景及技术路线图研究。考虑资源禀赋、能源结构和发展现状，以科技创新为核心，以资源、能源结构调整为依托，以流程优化、能效提升和工艺突破为主线，以绿色低碳产品、产业链协同为保障。

More than 400 experts from China's iron and steel industry carried out research on the vision and technology roadmap for carbon peaking and carbon neutrality in the iron and steel industry.Considering resource endowment, energy structure and development status, with scientific and technological innovation as the core, resource and energy structure adjustment as the support, process optimization, energy efficiency improvement and process breakthrough as the main line, green and low-carbon products and industrial chain collaboration as the guarantee.



钢铁行业碳达峰碳中和愿景

确保2030年前实现碳达峰，到2030年(近期），钢铁行业具备较2020年二氧化碳排放总量降低15%的资源条件和技术能力

Ensure carbon peaking by 2030, and by 2030 (recent past), the iron and steel industry has the resources and technological capability to reduce total CO2 emissions by 15 % from 2020 levels

到2040年（近中期），钢铁行业二氧化碳排放总量较2020年降低40%

Reduce 40 % of total CO2 emissions from the iron and steel sector by 2040 (near to medium term)from 2020 levels

到2050年（中远期），钢铁行业二氧化碳排放总量较2020年降低85%，通过产业链协同、更高性能钢铁产品升级应用等举措，可为下游行业和社会降碳约2.8亿吨，为实现碳中和夯实基础

By 2050 (medium to long term), the total CO_2 emissions of the iron and steel industry will be reduced by 85% from 2020 levels, and through industry chain collaboration, upgrading and application of higher performance iron and steel products and other initiatives, about 280 million tonnes of carbon will be reduced for the downstream industry and the society, which will solidify the foundation for achieving carbon neutrality.

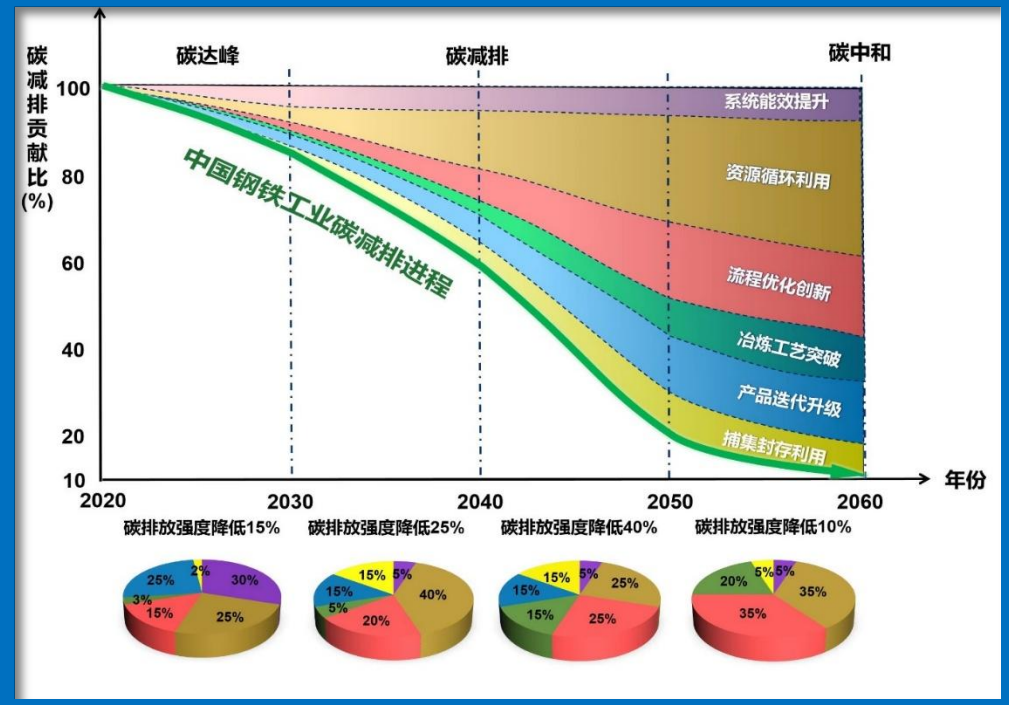
到2060年（远期），钢铁行业二氧化碳排放总量较2020年降低95%，借助碳汇与社会力量，实现碳中和

By 2060 (long term), the total CO_2 emissions of the iron and steel industry will be reduced by 95% from 2020 levels, and carbon neutrality will be achieved with the help of carbon sinks and social forces.

低碳技术路径 *Low-Carbon Technology Roadmap*

六大技术路径

1.system energy efficiency improvement,
2.resource recycling,
3.process optimization and reconstruction,
4.product performance improvement,
5.smelting process breakthrough,
6.capture, storage and utilization.



中国钢铁工业低碳技术路径贡献图

二、中国钢铁低碳发展愿景
Low-carbon Development Vision of Chinese Steel Industry

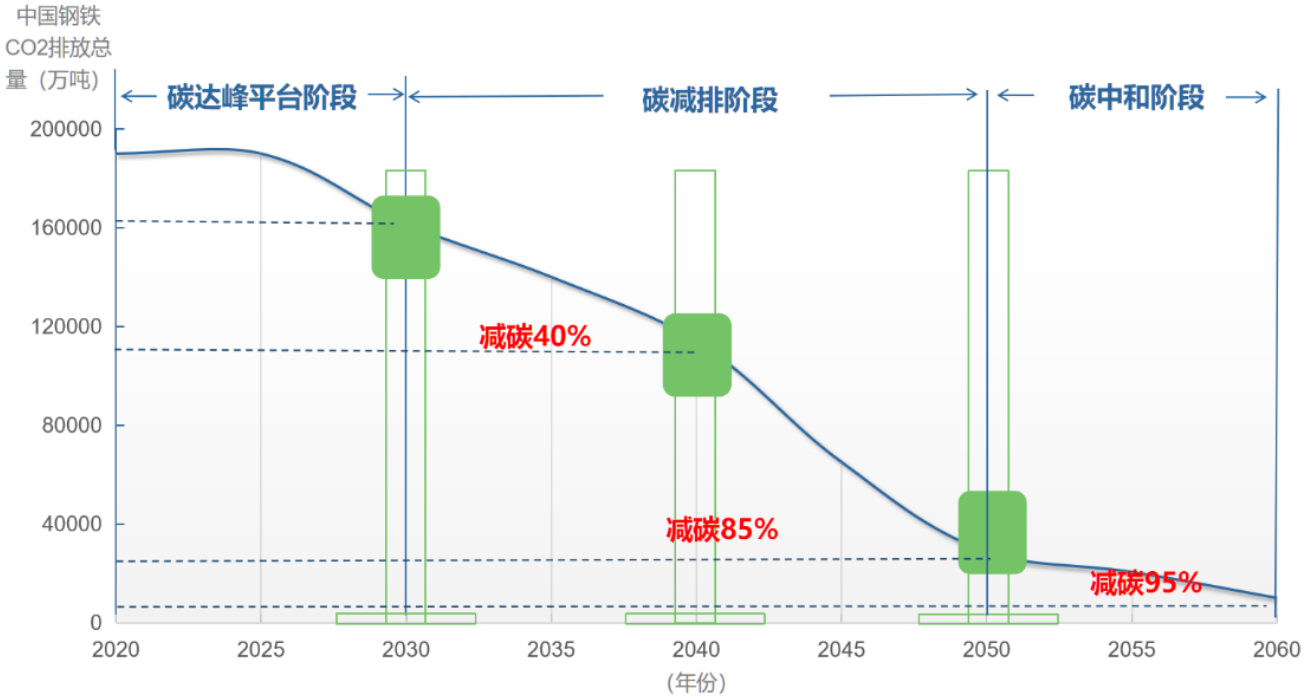
“碳达峰”平台阶段
"Carbon peak" platform stage

依托现有产业结构和工艺流程，系统能效提升将作为降碳主要路径，发挥关键作用；

Relying on the existing industrial structure and process flow, the improvement of system energy efficiency will play a key role as the main path to carbon reduction;

资源循环利用、流程优化创新、产品迭代升级作为支撑，着力于成熟技术的推广

Resource recycling, process optimization and innovation, product iteration and upgrading as support, focus on the promotion of mature technologies



“碳中和”阶段
”Carbon neutrality” stage

经济可行的捕集封存利用、冶炼工艺突破全面推广应用将成为关键。

Economical and feasible capture and storage utilization, smelting process breakthrough comprehensive promotion and application will play the key role

“碳减排”阶段
”Carbon reduction” stage

随着六大路径中关键技术创新和前沿技术取得进展，废钢资源和非高炉冶炼提供的铁素资源保障能力提升，资源循环利用、流程优化创新、冶炼工艺突破、产品迭代升级几大路径交替成为降碳的核心

With the progress of key technological innovation and cutting-edge technologies in the six major paths, the iron resource guarantee ability of scrap steel resources and non-blast furnace smelting has been improved, and the major paths of resource recycling, process optimization and innovation, smelting process breakthrough, and product iteration and upgrading have alternately become the core of carbon reduction

目　录/Content

实施极致能效工程　Optimal efficiency

- 中国钢铁行业以“三清单两标准一系统”为主线，从2022年开始实施“钢铁行业能效标杆三年行动方案”。
- Focusing on the extreme energy efficiency project, CISA takes “three lists, two standards and one system” as the main line, formulates the “Three-Year Action Plan for Energy Efficiency Benchmarking in the Steel Industry”.

Three Techniques

- 技术清单：最佳可行技术清单
- Best Available Techniques
- 能力清单：全球范围内极致能效相关技术合作伙伴清单
- Global Top-Tier Energy Efficiency Partners
- 政策清单：国家文件及绿色信贷为主的政策清单
- National Policies & Green Credit

Two

- 修订发布新的强制性国家标准
- Issued the mandatory national standard
- 制定钢铁企业重点工序能效标杆对标指南、评估规范两个团体标准
- Established two key group standards for benchmarking

One Data

- 能耗数据填报系统，夯实行业数据基础
- Energy consumption data reporting system strengthens data foundation

三、中国钢铁行业低碳发展情况
Low-carbon development of Chinese Steel Industry

2025年底，行业30%以上的产能达到能效标杆水平、能效基准水平以下产能基本清零，培育一批“双碳最佳实践能效标杆示范厂”

By end-2025, 30% capacity will reach the benchmark, with all sub-par capacity basically phased out, and cultivate a group of “Dual Carbon Best Practice Energy Efficiency Benchmark Demonstration Plants”.

- **143家**企业投身“双碳最佳实践能效标杆示范厂”培育，覆盖粗钢产能**70%左右。**
- **143 enterprises** have joined the cultivation of “Dual Carbon Best Practice Energy Efficiency Benchmark Demonstration Plants,” covering crude 70% of steel production capacity.

国民经济行业分类及代码			重点领域		指标名称	指标单位	标杆水平	基准水平	参考标准
大类	中类	小类							
石油、煤炭及其他燃料加工业（25）	煤炭加工（252）	炼焦（2521）	煤制焦炭	顶装焦炉	单位产品能耗	千克标准煤/吨	110	135	GB 21342
				捣固焦炉			110	140	
黑色金属冶炼和压延加工业（31）	炼铁（311）	炼铁（3110）	高炉工序		单位产品能耗	千克标准煤/吨	361	435	GB 21256
	炼钢（312）	炼钢（3120）	转炉工序		单位产品能耗	千克标准煤/吨	-30	-10	
			电弧炉冶炼	30吨<公称容量<50吨	单位产品能耗	千克标准煤/吨	67	86	GB 32050 注：电弧炉冶炼全不锈钢单位产品能耗提高10%。
				公称容量≥50吨			61	72	
	铁合金冶炼（314）	铁合金冶炼(3140)	硅铁		单位产品综合能耗	千克标准煤/吨	1770	1900	GB 21341
			锰硅合金				860	950	
			高碳铬铁				710	800	

吨钢投资
Investment per ton steel

78元RMB

吨钢综合能耗降幅
Decrease in comprehensive energy consumption of per ton steel

0.61%

节 能 量
Energy saving quantity

1050万吨标准煤

极致能效工程 Extreme Energy Efficiency Project

注：2024年中国钢铁工业协会会员企业统计数据

口 开展低碳技术研发 Low-Carbon steel technology innovation in China

1. 富氢或全氢气基直接还原技术
Hydrogen rich/full hydrogen gas-based DRI technology
2. 富氢碳循环高炉技术
Hydrogen rich carbon recycling BF technology
3. 氢基熔融还原技术
Hydrogen-based smelting reduction technology

氢冶金技术范畴

4. 近零碳排放电炉流程技术
Near zero carbon emission technology for EAF steelmaking
5. 钢铁近终型制造技术
Near net shape manufacturing technology
6. 高废钢比高效转炉技术
High Scrap Ratio and High Efficiency Converter Technology

流程变革技术范畴

7. 冶金渣显热回收及高效化资源利用技术
Technology on sensible heat recovery and efficient recycling of metallurgical slag

极致能效技术范畴

8. 二氧化碳捕集及资源化利用技术
CO_2 capture and reutilization technology

末端控碳技术范畴

钢铁行业关键共性技术，指的是对行业科技进步有重大推动作用并具有普遍推广应用价值的关键性工艺和装备技术。当前我国和世界上正在进行的主要重大研究有8个方向，任何一个方向的突破都会为中国和世界钢铁工业实现碳中和做出重大贡献。

摘自中国钢铁工业协会党委书记何文波
2022（第十三届）中国钢铁发展论坛致辞

□ 低碳技术研发应用进展情况（Research-development progress on Low-carbon Technology）

	技术名称/Technical name	理论最佳减碳效果/Theoretical best carbon reduction effect	实施企业/Implementing enterprise	所处阶段/Stage at which
1	富氢/全氢气基直接还原技术（含竖炉、流化床等）/Hydrogen rich/full hydrogen gas-based DRI technology(including shaft furnace, fluidized bed,etc.)	50%以上（视氢气用量变化）/Over 50% (depending on the variation in hydrogen usage)	宝武集团、中南大学、中钢设备、中钢洛耐院 BAOWU, CSU, SINOSTEEL MECC, SINOSTEEL LMTC	产业化示范/Industrial Demonstration
			河钢集团、建龙集团、东北大学 HBSI, Jianlong Group, NEU	产业化示范/Industrial Demonstration
			中国钢研 CISRI	中试/Pilot Testing
			鞍钢集团 ANSTEEL	研发中试/Research and Development Pilot Testing
			中信特钢 CITIC Special Steel	研发/Research
2	富氢碳循环高炉技术/Hydrogen rich carbon recycling BF technology	40%以上/Over 40%	宝武八钢、中钢设备 BAOWU SINOSTEEL MECC	中试、产业化示范/Pilot Testing/Industrial Demonstration
			建龙集团、东北大学、中国钢研 Jianlong Group, NEU, CISRI	产业化示范/Industrial Demonstration
			河钢集团 HBSI	研发中试Research and Development Pilot Testing
			首钢集团、中冶京诚、中信特钢 Shougang Group, CITIC Special Steel	研发/Research
3	氢基熔融还原技术/Hydrogen-based smelting reduction technology	10%-25%（视氢气用量变化）/10%-25%(depending on the variation in hydrogen usage)	建龙集团 Jianlong Group	中试 /Pilot Testing
4	近零碳排电炉流程技术/Near zero carbon emission technology for EAF steelmaking	80%以上/Over 80%	宝武湛江、中国钢研、河钢集团 BAOWU, CISRI, HBSI	产业化示范/Industrial Demonstration
			建龙集团、北京科技大学、东北大学 Jianlong Group, USTB, NEU	研发中试/Research and Development Pilot Testing

□ 低碳技术研发应用进展情况（Research-development progress on Low-carbon Technology）

	技术名称/Technical name	理论最佳减碳效果/Theoretical best carbon reduction effect	实施企业/Implementing enterprise	所处阶段/Stage at which
5	钢铁近终型制造技术/Near net shape manufacturing technology	钢轧工序减碳85%/85% reduction in carbon emissions in the steel rolling process.	宝武八钢、中国钢研、沙钢集团、敬业集团、东北大学、山西宏达、中钢设备、宝钢工程 BAOWU, CISRI, SHAGANG Group, Jingye Group, NEU, Shanxi Hongda, SINOSTEEL MECC,	产业化示范/Industrial Demonstration
			北京科技大学 USTB	中试 /Pilot Testing
			中钢洛耐院（配套耐材） SINOSTEEL LMTC	研发中试/Research and Development Pilot Testing
6	高废钢比高效转炉技术/High Scrap Ratio and High Efficiency Converter Technology	减碳25%-30%（废钢比40-50%）/A 25%-30% reduction in carbon emissions (with a scrap steel ratio of 40-50%).	中国钢研 CISRI	研发中试/Research and Development Pilot Testing
			宝武集团、北京科技大学 BAOWU, USTB	中试/Pilot Testing
			首钢集团 Shougang Group	研发中试/Research and Development Pilot Testing
7	冶金渣显热回收及高效资源化利用技术//Technology on sensible heat recovery and efficient recycling of metallurgical slag	吨钢减少5%/A 5% reduction in steel per ton	中国钢研、中国五矿、东北大学、首钢集团、河钢集团 CISRI, MCC, NEU, Shougang Group, HBSI	研发 /Research
8	CO_2捕集及资源化利用技术/CO_2 capture and reutilization technology	视利用规模及排放量不同，为终端减碳技术 /Depending on utilization scale and emissions, it serves as terminal carbon reduction technology	包钢集团 Bao Gang United Steel	产业化示范/Industrial Demonstration
			建龙集团、宝武集团、鞍钢集团、山钢集团、中冶焦耐、河钢集团、首钢集团 Jianlong Group, BAOWU, ANSTEEL, SHANSTEEL, MCC ACR, HBSI, Shougang Group	研发中试/Research and Development Pilot Testing

富氢/全氢气基直接还原技术

Hydrogen rich/full hydrogen gas-based DRI technology

- 主要实施企业：河钢集团有限公司
- 建设周期：2019-2022年底
- 进展情况：2023年，河钢集团张宣科技实现安全连续生产，DRI产品金属化率达到94%，与同等生产规模的传统高炉长流程相比，可实现碳减排70%以上，同时二氧化硫、氮氧化物和烟粉尘排放分别减少30%、70%和80%以上。

Enterprise: HBIS
Construction period: 2019-late 2022
Progress: In 2023, Zhangxuan Technology Co. from HBIS achieved continuously safe production, with 94% metallization rate in DRI products, and reducing CO_2 emissions by more than 70%, SO_2, NOx, smoke and dust emissions respectively by over 30%, 70%, 80%, compared with the traditional BF route with the same production scale.

绿氢流化床直接还原技术/Green hydrogen fluidized bed direct reduction iron technology

主要实施企业：中国鞍钢集团有限公司

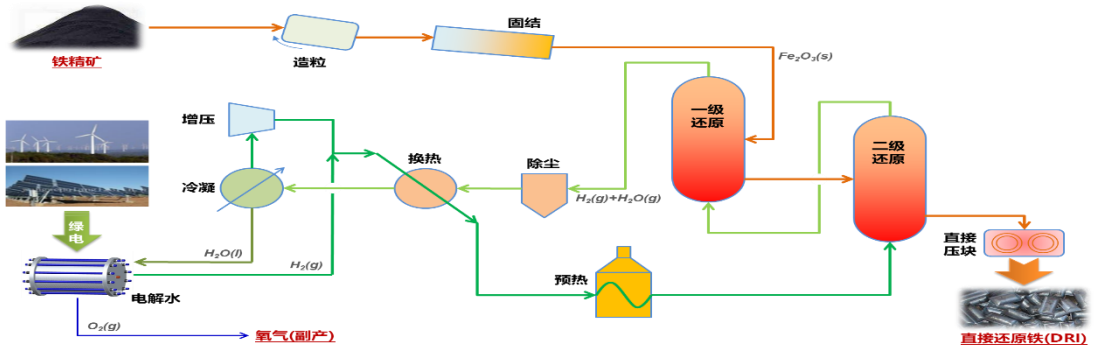
Enterprise: China Ansteel Group Corp. Ltd

建设周期：2022-2023

Construction period: 2022-2023

进展情况：2023年12月，鞍钢集团万吨级绿氢流化床氢冶金中试线建成，重点解决了绿氢高效制备、氢冶金原料适用性、抗粘结失流等技术难题，实现了全流程工艺贯通，形成具有完全自主知识产权的绿氢流化床直接还原铁新技术，直接还原铁金属化率大于95%，吨铁CO_2排放量较传统高炉流程降低90%以上。目前，中试线正开展连续运行试验。

Progress: In December 2023, Ansteel Group completed the construction of a 10,000-ton-class pilot line for green hydrogen fluidized bed hydrogen metallurgy. The project has successfully addressed key technical challenges, including high-efficiency green hydrogen production, raw material adaptability for hydrogen metallurgy, and anti-adhesion technology. It has achieved full-process technological connection and developed a new proprietary technology for direct reduced iron (DRI) production via green hydrogen fluidized bed, with core independent intellectual property rights. The metallization rate of the DRI exceeds 95%, while CO_2 emissions per ton of iron are reduced by over 90% compared with the traditional blast furnace process. Currently, the pilot line is undergoing continuous operation testing.



富氢碳循环高炉技术/Hydrogen rich carbon recycling BF technology

主要实施企业：中国宝武钢铁集团有限公司

Enterprise: China Baowu Steel Group Co.Ltd

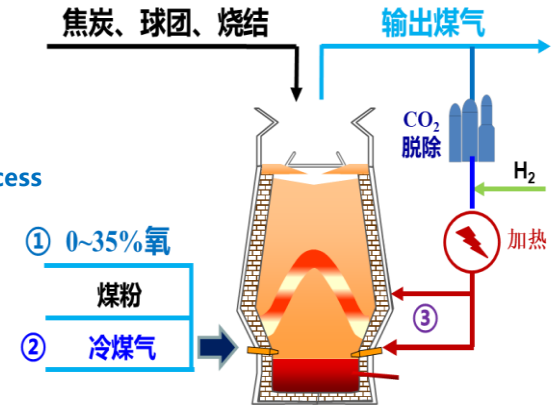
建设周期：2021-2023

Construction period: 2021-2023

进展情况：2022年7月，宝武集团400m³级富氢碳循环氧气高炉(HyCROF)建成，重点解决了煤气CO_2脱除、煤气加热、复合喷吹、煤气流分布等技术难题，实现了固体燃料消耗降低达30%，碳减排超21%目标，打通了富氢碳循环氧气高炉工艺技术，为钢铁工业低碳转型发展提供“中国方案”。目前，宝武集团启动了 2500m³高炉HyCROF商业化示范项目改造工程。

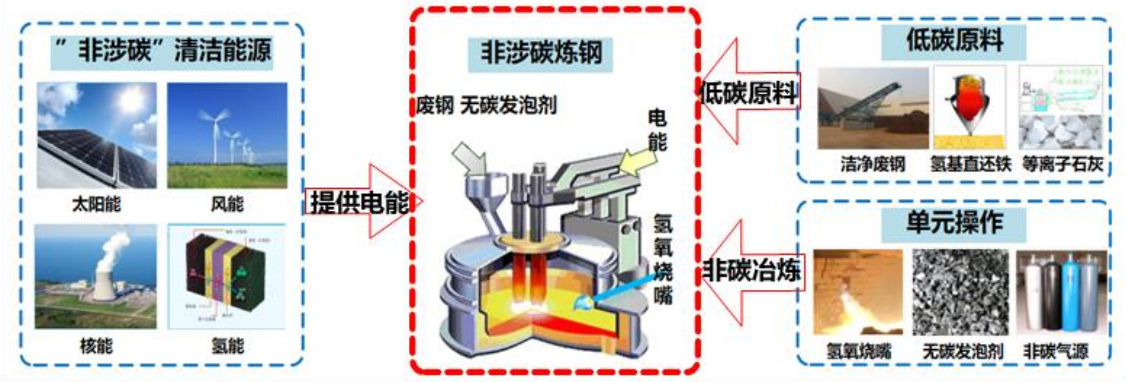
Progress: In July 2022, Baowu completed the construction of 400m³ Hydrogen rich carbon recycling BF (HyCROF), mainly solving technological difficulties including gas CO_2 removal, gas heating, compound injection and gas flow distribution , achieving cutting solid fuel consumption by 30% and carbon emission by 21% and contributing “Chinese solutions” for the low carbon transition and development of the steel industry . Currently, Baowu has launched 2500m³ HyCROF commercial demonstration project renovation.

工艺示意图
Schematic diagram of process



电炉炼钢近零碳排技术

Near zero carbon emission technology for EAF steelmaking



技术间意图

- **主要实施企业：** 北京科技大学、河钢集团有限公司
- **进展情况：** 完成10吨近零碳排电炉的中试工程建设，推进年产100万吨氢基直还铁-近零碳排工程； 近零排放电炉主要技术指标：吨钢电耗≤320kWh，CO_2排放≤100kg。

Enterprise: Beijing Science and Technology University, HBIS

Progress: Completion of middle trial project construction for the near zero carbon emission 10-ton EAF; promotion of hydrogen-based DRI near zero carbon emission project with 1 million tons production per annum. Major indicators for the near zero carbon emission by EAF: electricity consumption per ton of steel ≤320kWh，CO_2 emissions≤100kg。

近零碳排炼钢

非涉碳冶炼： 高效洁净炼钢技术，包括非涉碳泡沫渣、高效供电、喷粉脱磷、脱气等；

低碳原料： 洁净废钢、氢基直还铁、合金、耐材等低碳生产；

供电来源： 绿电（风、太阳、水能、核能等）、闲余电能、蓄能发电；

Near zerocarbon emissions

Non-carbon smelting: high efficiency clean steelmaking technology, including non-carbon foam slag, high efficiency power supply, pulverized dephosphorization, degassing.

Low carbon raw materials: clean scrap, hydrogen-based DRI, alloy steel, refractories

Source of power supply: green electricity (wind, solar, water and nuclear energy), surplus energy , storage power generation.

□ 二氧化碳捕集及资源化利用技术/Carbon Capture and Resource utilization technologies

□ **主要实施企业：包头钢铁(集团)有限责任公司**

Enterprise: Baotou Steel Group Co.Ltd

□ **技术原理：以二氧化碳为原料，通过碳化反应，实现多介质常温钢渣直接碳酸化固定二氧化碳，以及多相复合体系强化钢渣固碳联产高附加值碳酸盐填料产品。**

Principles of technology: with CO_2 as raw materials, through carbonization, reaction carbon dioxide was directly carbonated from steel slag at room temperature, and high value-added carbonate filler products were produced by strengthening steel slag carbon fixation through multi-phase composite system.

□ **进展情况：目前在建年消耗10万吨钢渣示范产业化项目，预期年减碳量达11.2万吨。**

Progress: Currently, the demonstration industrialized project with an annual consumption of 100,000 tons of slag has been completed, expected to reduce carbon emissions of 112 thousand tons per year.

项目现场
Project site

钢铁全产业链EPD平台
WWW.EPDCHINA.COM

□ EPD平台建设 EPD platform construction

全球发布钢铁EPD报告最具时效性、数据量最丰富的平台

The world's most timely and data-rich platform for publishing steel EPD reports.

23PCRs
产品种类规则PCR 23份

300 EPD reports
EPD报告 300份

9000+ registered users
注册用户 9000+家

70,000+ reports downloaded
报告下载 70000+

- □ 已与瑞典EPD国际体系、意大利EPD平台、美国EPD Networks平台签署平台合作备忘录
- □ 与日本可持续管理促进组织（SuMPO）EPD平台达成签订PCR互认谅解备忘录意向，与丹麦碳管理平台QuantifiedImpacts达成合作意向。
- □ EPD报告成功用于出口订单，被欧美用户采信。

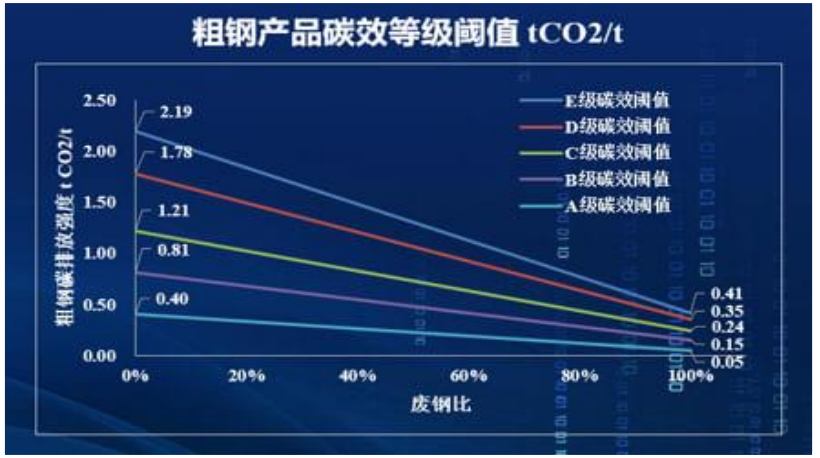
- The platform has signed a Memorandum of Understanding (MoU) with the International EPD® System (Sweden) 、the Italian EPD Platform and EPD Networks (USA).
- It has reached intentions to sign PCR mutual recognition MoUs with the SuMPO EPD Platform (Japan), and established collaboration intent with Denmark's carbon management platform QuantifiedImpacts, with plans to sign framework agreements on EPD acceptance and PCR development.
- Magang's English EPD report has been successfully used for export orders, and has been formally recognized by European and US end-users.

- 发布低碳排放钢标准C2F Steel
- Release low-carbon emission steel -China decarbonized ecological future-oriented (C2F) steel standards

基于中国约3.3亿吨粗钢产能数据，制定了中国《低碳排放钢评价方法》标准。已发布了23个低碳排放钢，生产工艺涵盖高炉转炉长流程和电炉短流程，涉及产品应用于交通、能源、建筑、电力等重点用钢行业。

Based on the data of China's crude steel production capacity of about 330 million tons, the standard of China's "Method for the assessment of China decarbonized ecological future-oriented steel" was formulated.

23 low carbon emission steels were released, with production processes covering blast furnace converter long process and electric furnace short process, involving products applied in key steel-using industries such as transportation, energy, construction and power.



划分5级碳效等级，从低到高依次为E级(入门级)、D级、C级、B级和A级，其中A级碳效为近零排放。

The carbon efficiency was classified with five levels, namely E-level (Entry-level), D-level, C-level, B-level, and A-level from low to high. Among them, A-level carbon efficiency represents near-zero emissions.

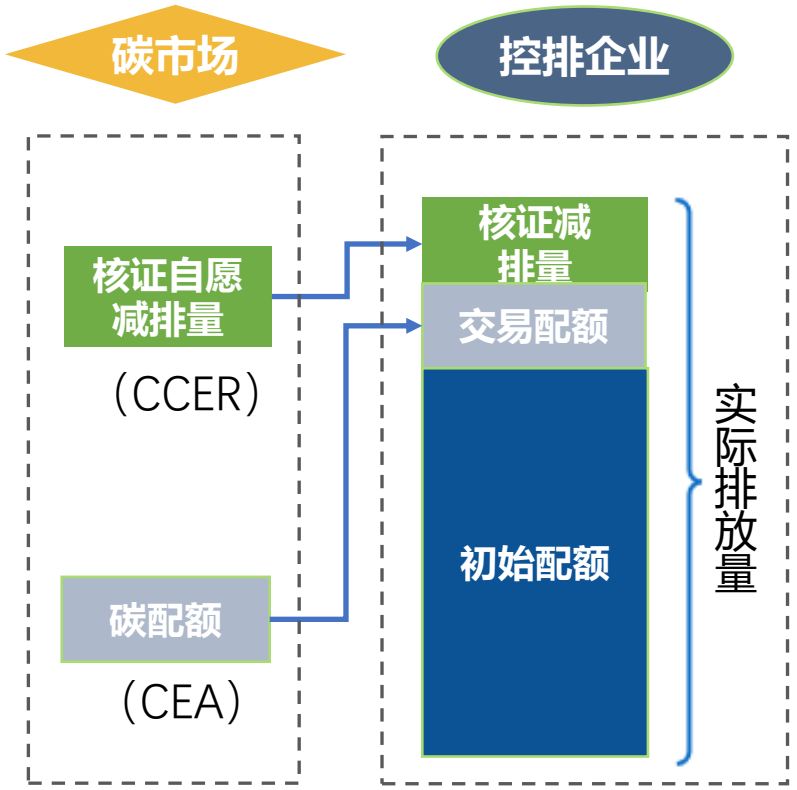
标准应用--关于中国房地产低碳排放钢的合作声明
Collaboration Statement on Low Carbon Emissions Steel for Real Estate in China

- 2024年11月29日，关于中国房地产低碳排放钢的合作声明启动仪式在北京举行；The launch ceremony of the Collaboration Statement on Low Carbon Emissions Steel for Real Estate in China was held in Beijing On November 29, 2024,
- 中钢协、城市土地学会和世界钢协共同发起；CISA、 WSA and ULI are coinitiators.
- 旨在**加速房地产行业减少钢铁排放的进程**。The undersigned real estate companies are committed to reducing GHG emissions across their value chain

促进标准互认及可操作性
Collaboration Statement on Low Carbon Emissions Steel for Real Estate in China

- Carry out exchanges with the World Trade Organization, International Energy Agency, the World Steel Association,Japanlron and Steel Federation, German Steel Federation,Responsible Steel, Rocky Mountain Institute,GSCC,ArcelorMittal, etc., to promote mutual recognitionand interoperability.
- CISA have participated in the "Steel Standards Principles" launched by WTO and WSA.
- MOU signed with RS: both parties will cooperate to promote interoperability.

碳市场促进中国钢铁行业低碳发展
Carbon market promotes low-carbon development of Chinese steel industry



◆ 碳市场是控制温室气体排放、实现碳达峰碳中和的**重要举措**。

Carbon market is an important measure to control greenhouse gas emissions and achieve carbon peaking and carbon neutrality.

◆ 中国于2021年启动**全国碳排放权交易市场**，由重点排放单位履行强制减排责任。发电行业成为首个纳入全国碳市场的行业，2025年扩大到钢铁行业。

The national carbon emissions trading market launched online trading on 2021,Key emission units fulfill mandatory emission reduction responsibilities.The power generation industry was the first industry to be included,and the Steel Industry has been included in 2025.

◆ **全国温室气体自愿减排交易市场**于2024年启动。

The national trading market for voluntary greenhouse gas emission reduction launched online trading on 2024 .

钢铁让世界更美好!

Steel Making a Better World！

中国钢铁工业是世界钢铁工业的一部分，中国钢铁工业的发展壮大得益于快速增长的中国市场，也离不开国际同行们的支持和帮助。中国钢铁未来将更加积极主动地开展国际交流合作，主动参与和引领全球钢铁治理，推动世界钢铁工业共同可持续发展。

The Chinese steel industry is an integral part of the world steel industry. The rapid development of the Chinese steel industry is attributable to the rapid growth of the Chinese economy and the support from peers in the world. We look forward to working with all for the common and sustainable development of the steel industries of the whole world.