



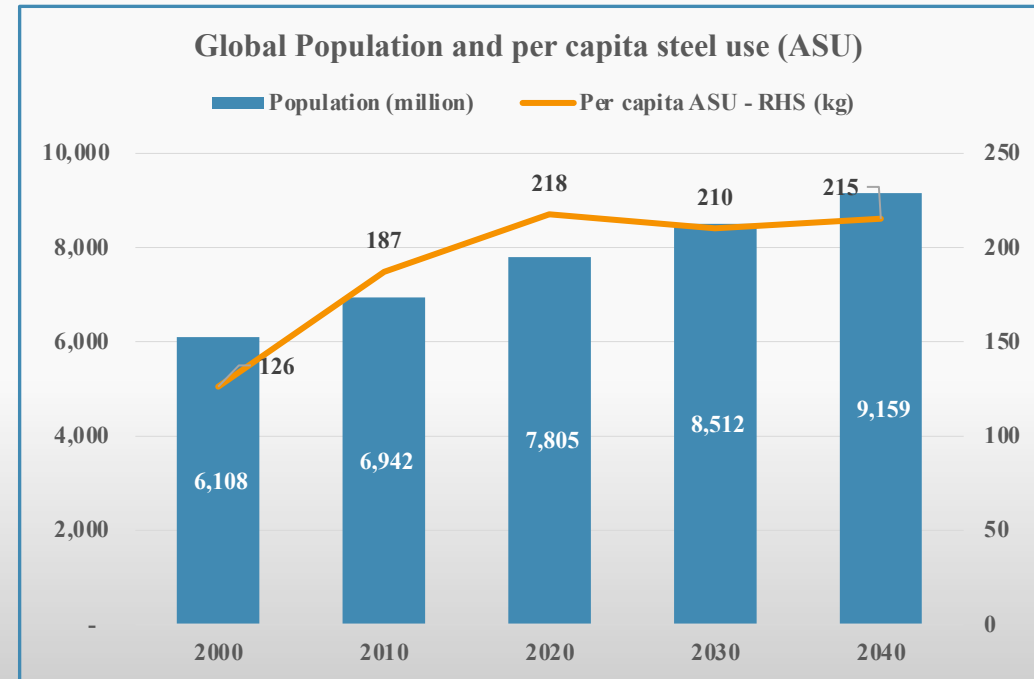
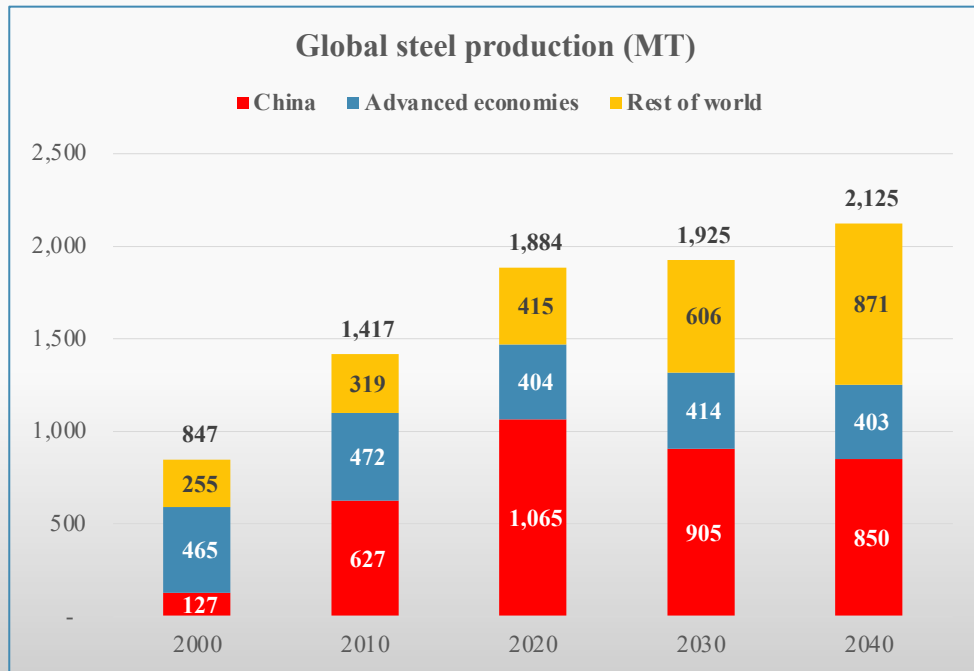
The role of scrap in steel industry decarbonization

Presentation to the OECD Steel Committee

Paris, March 25, 2024

Global steel production

WSD expects global steel production to increase to 1,925 MT in 2030 and to 2,125 MT in 2040 due to population growth and rising incomes in developing countries.

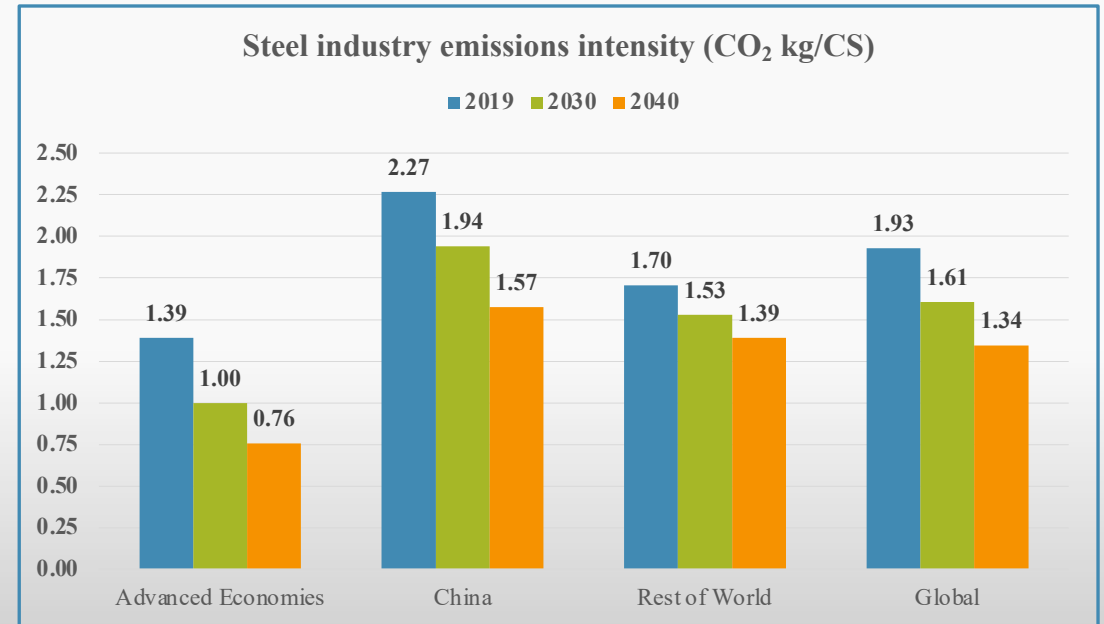
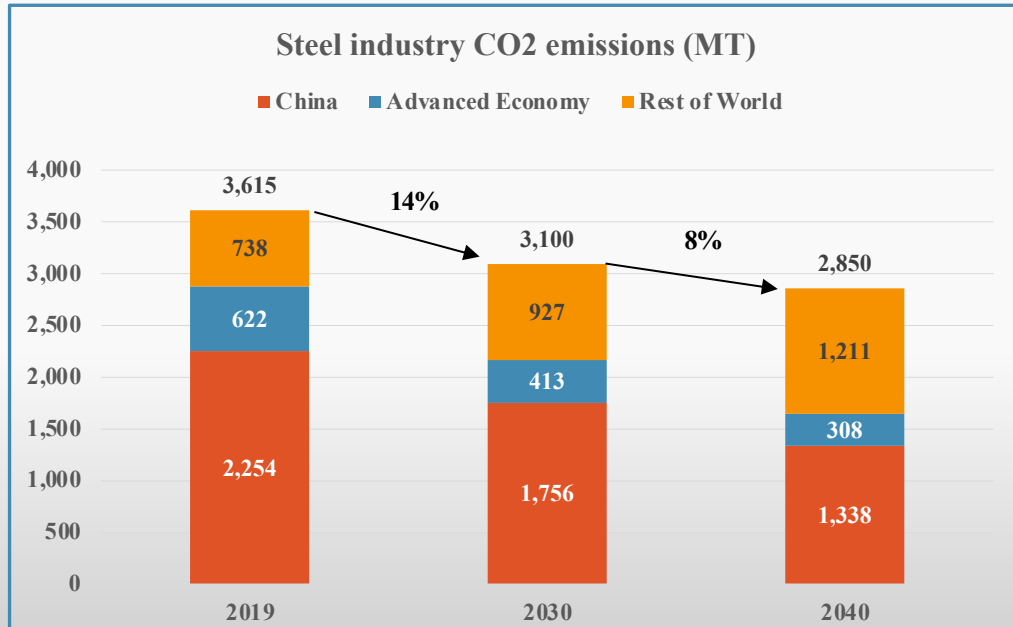


Source: UN population statistics, World Steel Association (WSA), WSD analysis.

8%

Global CO₂ emissions and emissions intensity

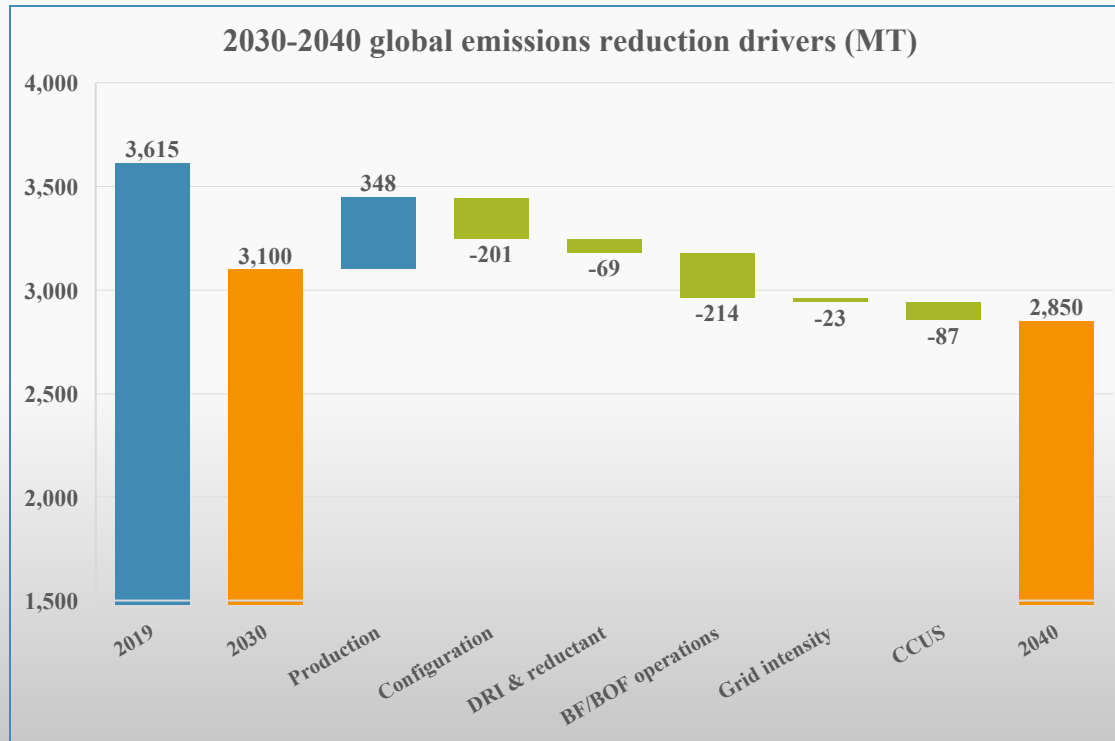
WSD expects global steel industry emissions to decrease 14% to 3,100 MT (1.61 CO₂ kg/tCS) this decade and 8% to 2,850 MT (1.34 CO₂ kg/tCS) by 2040.



Source: WSD analysis

Emissions reductions drivers

WSD’s emissions forecast model quantifies six drivers. The 200 MT increase in global steel production adds almost 350 MT of emissions before incorporating the impacts of the other drivers.

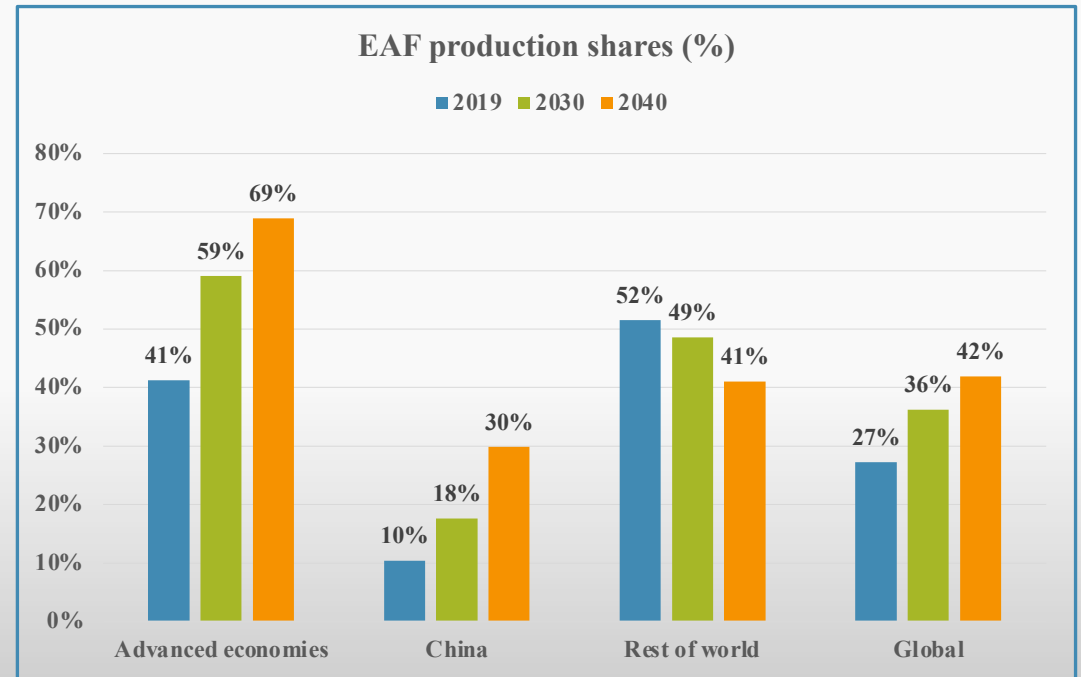
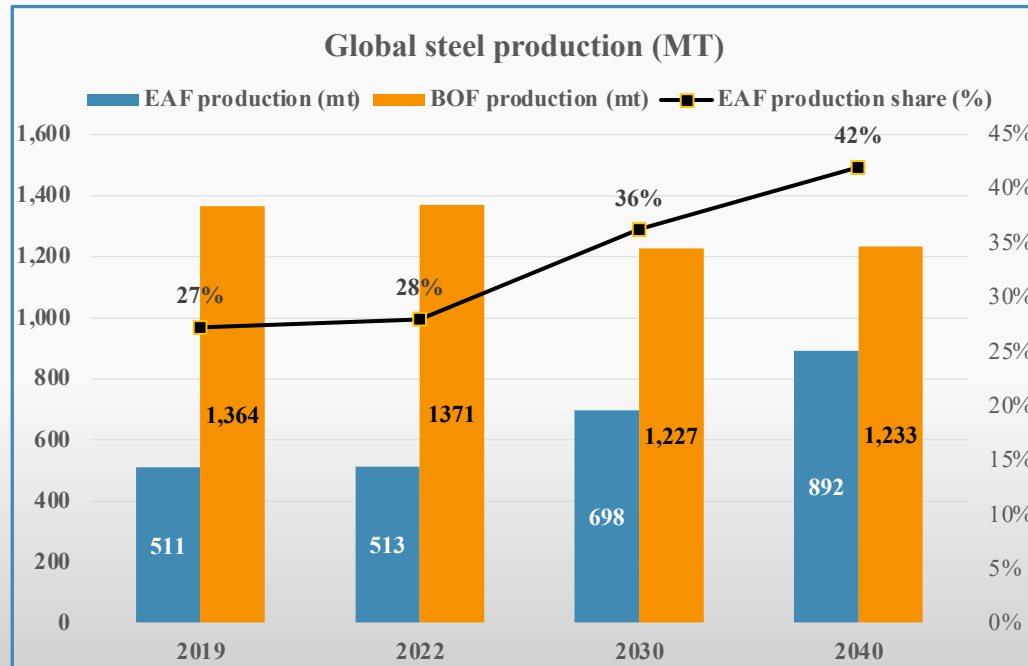


Source: WSD analysis,

Global steel industry decarbonization drivers	
Steel production	The 2040 average emissions intensity of the additional production is 1.75 CO ₂ kg/tCS, higher than the overall average of 1.34 due to India and ASEAN BF/BOF growth.
Configuration	Global EAF production share increases from 28% today to 36% in 2030 to 42% in 2040, driving a ~200 MT reduction in emissions. China’s EAF share increases from 10% to 18% in 2030 and to 30% in 2040.
DRI charge ratio and reductant mix	DRI production increases from 125 MT in 2022 to 175 MT in 2030 and to 225 MT in 2040. Green hydrogen reaches 26% share in shaft furnaces. India coal-based DRI declines.
BF/BOF route CO ₂ intensity	Global average BF/BOF intensity declines from 2.29 kg/tHM in 2019 to 2.09 in 2030 and to 1.86 in 2040. The 2040 global average BF fuel rate falls to 482 kg/tHM, the coke rate to 315 kg/tHM and the BOF hot metal ratio to 82.5%.
Power grid CO ₂ intensity	Global average of specific region figures is assumed to decline around 15% between 2030 and 2040.
Carbon capture use and storage	Base case 2040 global average CCUS adoption rates of 10% for DRI shaft operations and 4% for blast furnaces.

EAF production share

WSD expects the global EAF production share to increase from 27% in 2019 to 36% in 2030 and to 42% in 2040 driven by substantial increases in obsolete scrap availability in all regions, especially China.

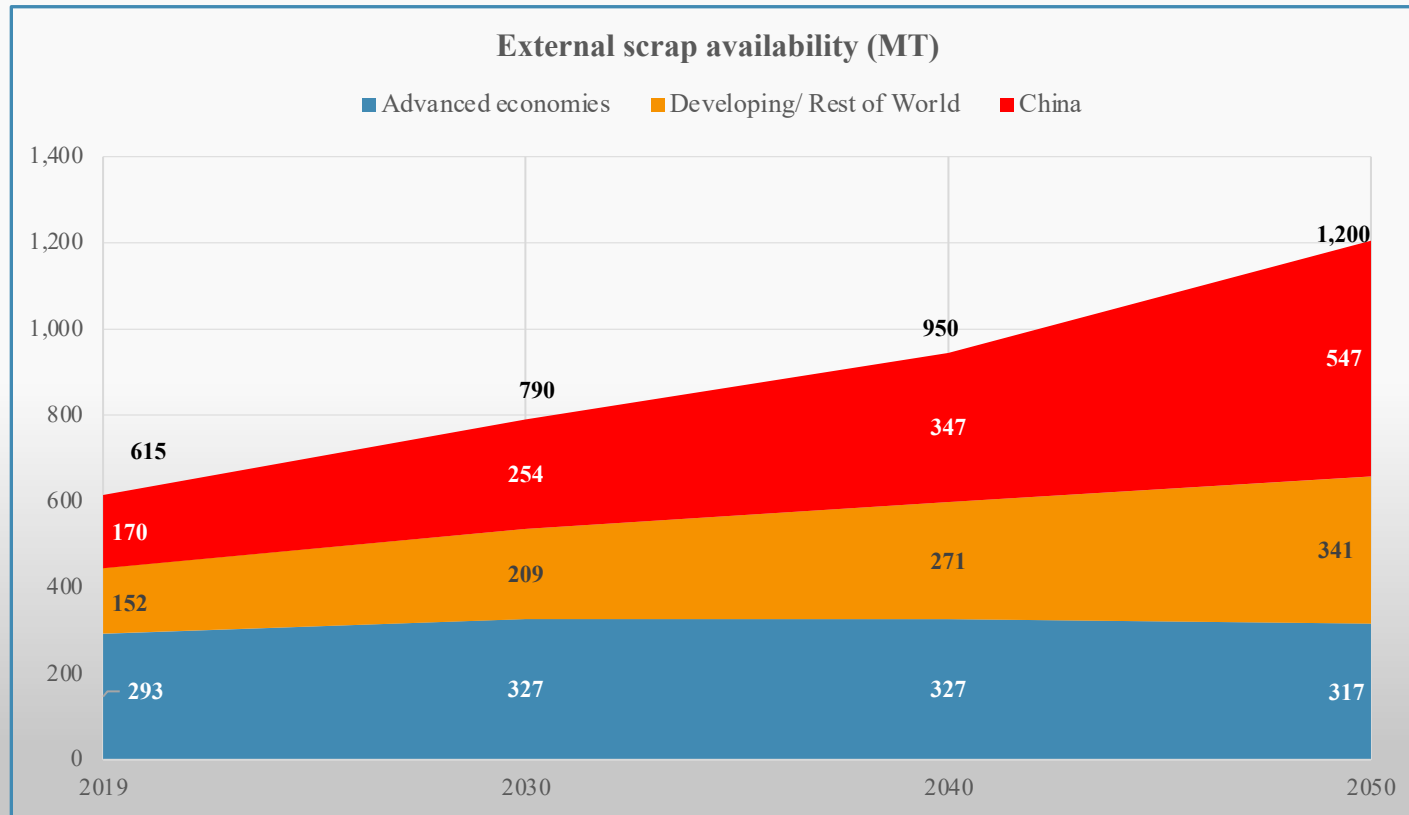


Advanced economies consist of EU countries, USMCA countries, Japan, Korea and Taiwan. The UK and Australia are excluded based on regional classification.

Source: WSA, WSD analysis

External scrap availability

External scrap (prompt plus recoverable obsolete) availability is expected to nearly double by 2050, with more than 80% of the increase in China.

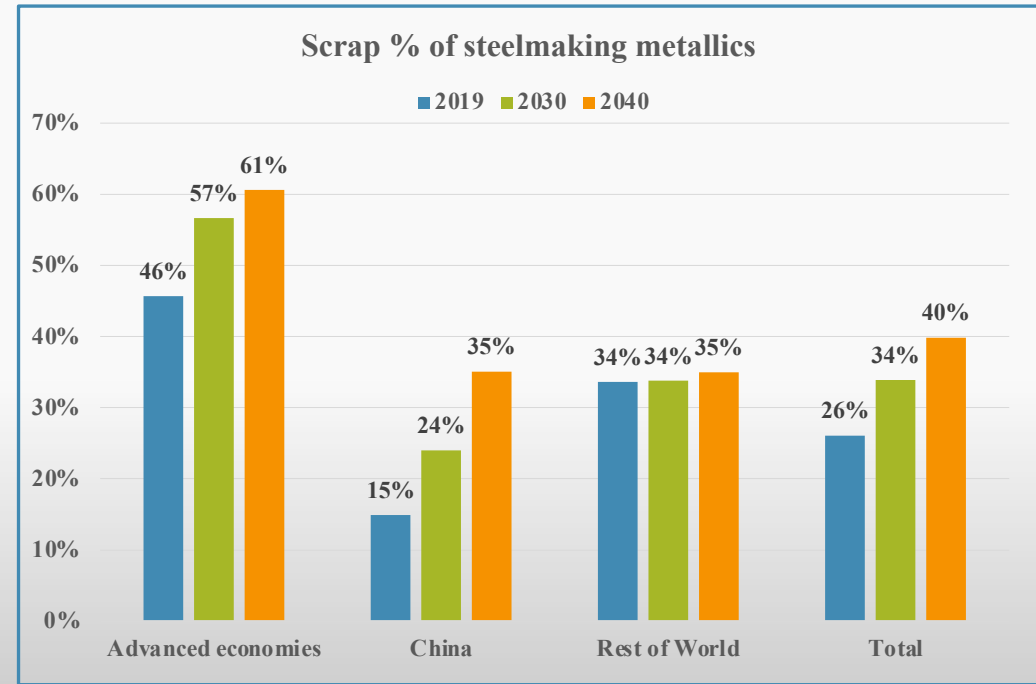
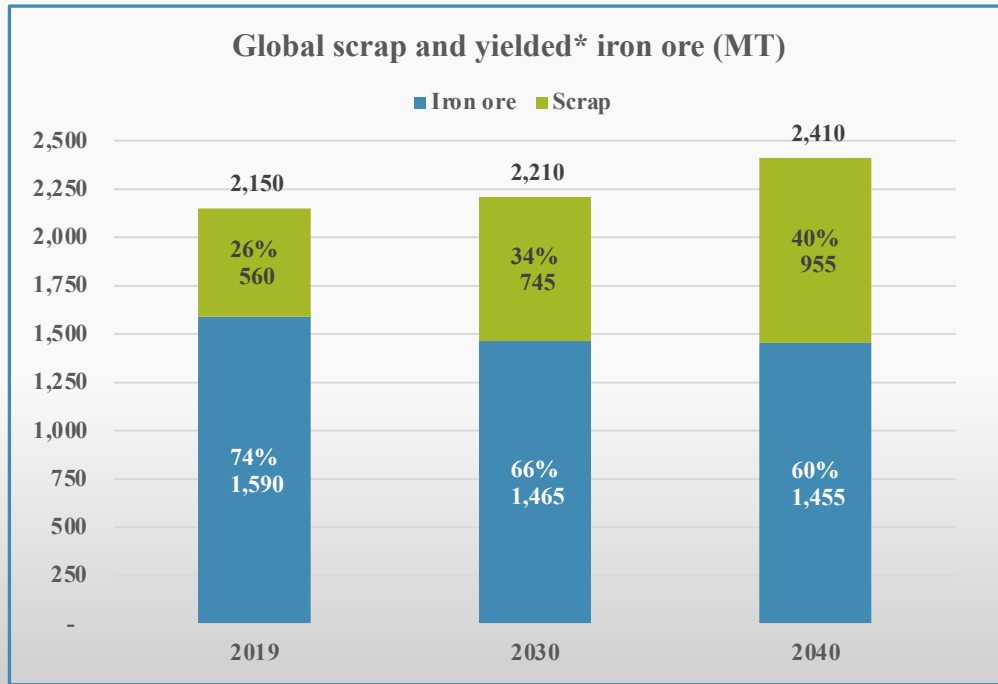


- Availability in the advanced economies increases slightly to 2030, then starts to decline after decades of declining steel consumption.
- Availability in the rest of the world gradually increases as steel consumption grows.
- WSD’s preliminary 2050 forecast suggests that China would have sufficient scrap to increase the EAF share to 50% and still have 80 MT of excess scrap availability.

Source: WSD analysis

Steelmaking metallics

The total scrap (external plus home scrap) metallic share increases from 26% in 2019 to 40% in 2040 driven by China and the advanced economies.

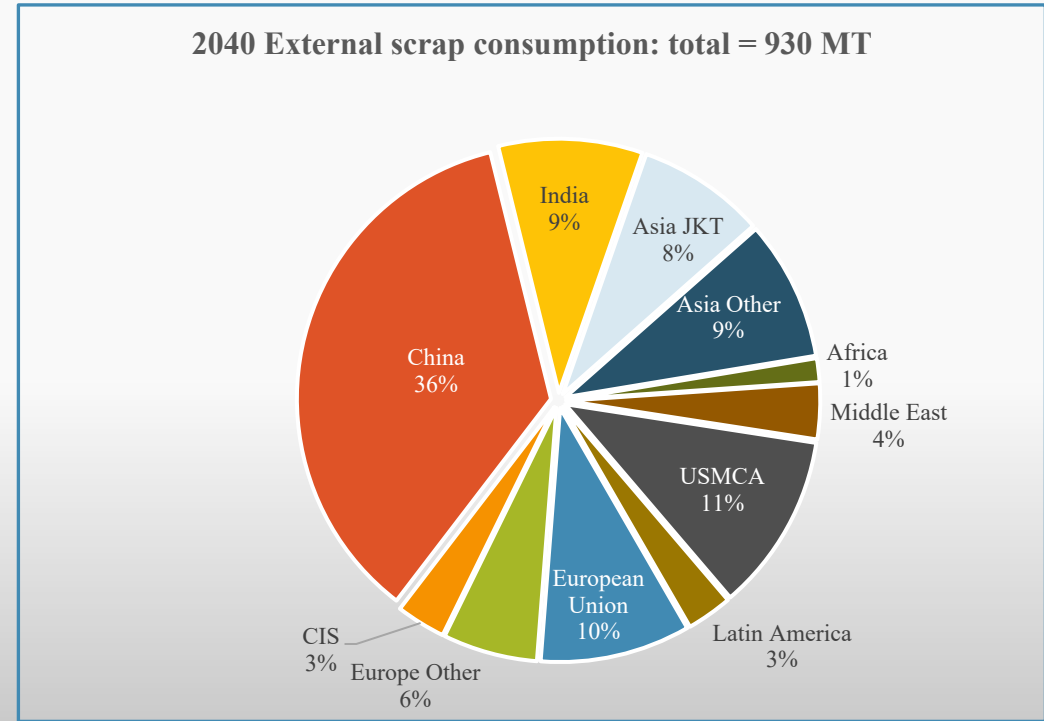
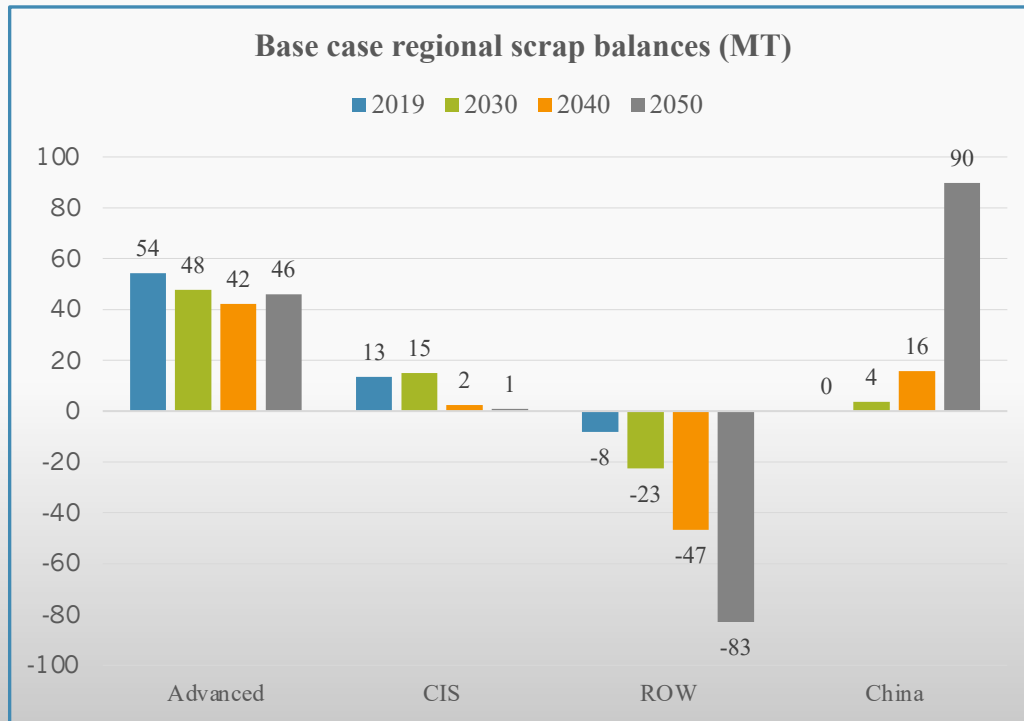


* Iron ore yielded @1.45 t/t to pig iron., includes home scrap, excludes foundry scrap.

Source: WSD analysis

Regional scrap imbalances

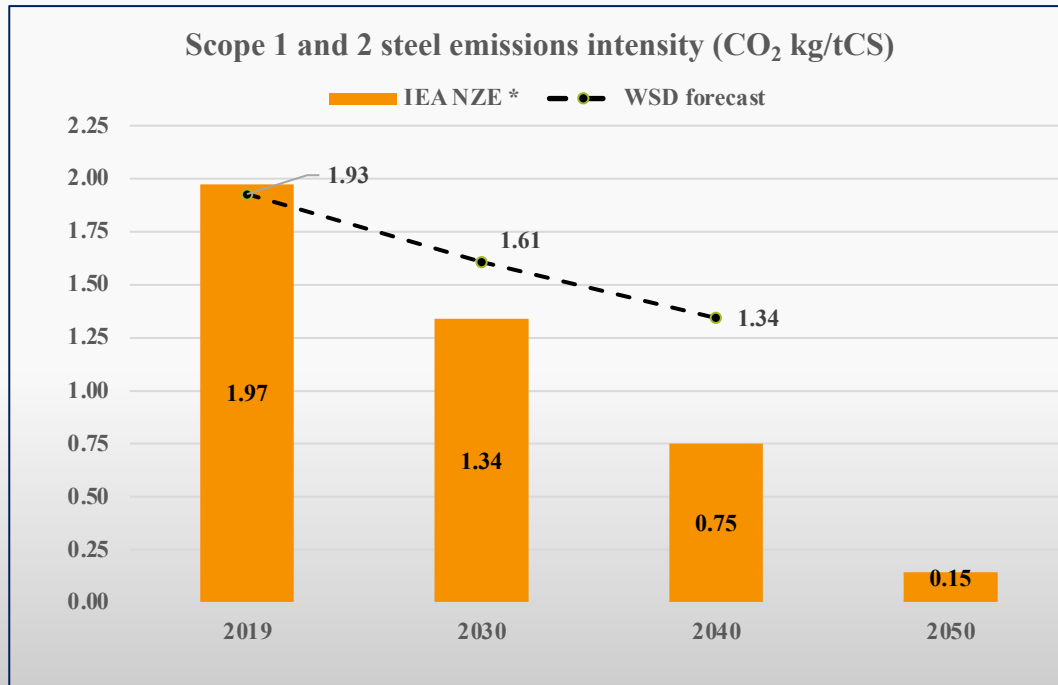
There is sufficient global scrap availability to reach the EAF production share and BOF hot metal ratio outlined in this Report, but it requires unrestricted flows from scrap-rich to scrap-poor regions to achieve the targeted reductions.



Source: WSD analysis

Progress, still a long way still to go

A reduction of industry CO₂ emissions to 1.34 kg/tCS by 2040 represents significant progress, but it still leaves the industry above the IEA's NZE implied trendline to 2050. Some acceleration may be possible, but not enough.



2040 global average sensitivities – not necessarily additive

Parameter	Base case	New value	Emissions change (MT)	Intensity change (kg/tCS)
EAF production share	41%	46%	-130 MT	-0.06
Green H ₂ DRI rate (reductant %)	26%	50%	-20 MT	-0.01
BF H ₂ injection (kg/tHM)	7.6	15	-50 MT	-0.02
BOF hot metal ratio	82.5%	80%	-65 MT	-0.03
BF CCUS capture rate	4%	10%	-85 MT	-0.03
DRI CCUS capture rate	10%	25%	-20 MT	-0.01

- The IEA does not specify 2030 and 2040 Scope 1 and 2 targets for its steel NZE scenario. The IEA data shown above are WSD interpolations of partial IEA data in *the 2023 Breakthrough Agenda Report for Steel*, (<https://www.iea.org/reports/breakthrough-agenda-report-2023/steel>) and other reports.

Source: WSD analysis

Contact us to learn more about our steel decarbonization work including customized analyses.

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