



China DRI/SRI market and effects on iron ore study

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SMM bases on primary research, internal database and modelling, successfully help our client deeply understand China DRI/SRI market and its effects on iron ore market

Project Background

DRI/SRI is a popular route to decarbonization. With the deepening of decarbonization and China's large steel production capacity, will China's DRI/SRI demand will boom in the future? What changes will it bring to the Chinese iron ore market? What is the layout for gaint steel mills in China?

The target customer wants do an in-depth study on China's DRI/SRI , leading technologies and its influence on iron ore market, and hopes to have a better understanding of China market.

Key Output

- China DRI/SRI supply status
- Forecast of China DRI/SRI supply(2022-2050)
- China overseas investment in DRI/SRI project
- Effects on China iron ore market
- China overseas investment in DR pellet feeds project

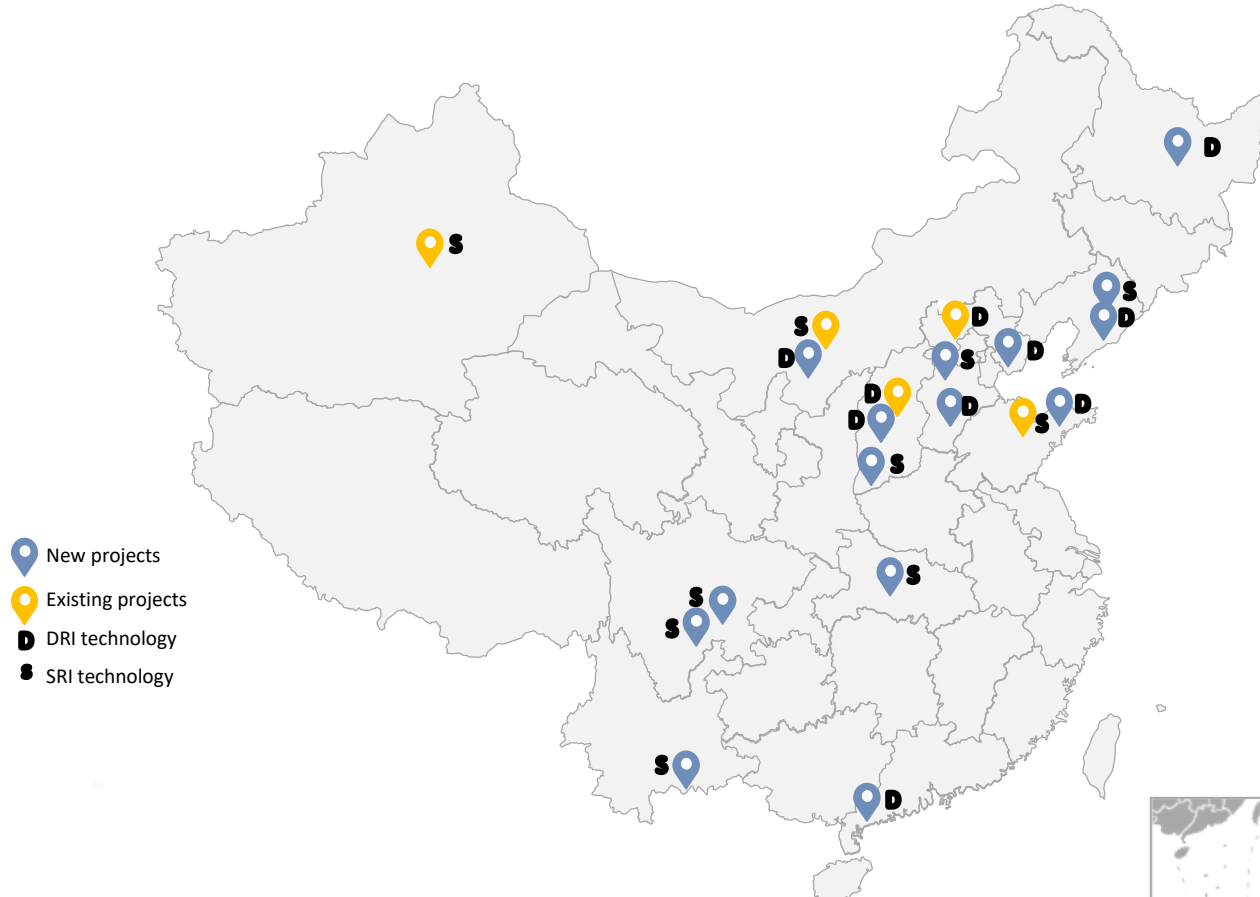
SMM Methodology

Main Research Methodology:

- **Desktop Research:** SMM databases, industry public reports, decarburization policy, etc. to comprehensively understand China's DRI/SRI market status and expectations, China's DR pellet feeds market status and expectations
- **Primary Research:**
 - Industry level: Conduct in-depth interviews with industry experts from steel and DRI/SRI market, China Iron and Steel Association(CISA), Hydrogen metallurgy research institute, industry policy research expert, etc.
 - Company level: Conduct in-depth interviews with different DRI/SRI steel mills, large steel mills, China domestic iron ores, China overseas equity mines, production technical experts, etc

“Replacing coal with hydrogen” to smelt “green steel”, HBZX achieves milestone, and China's non-blast furnace ironmaking welcomes new development

➤ China non-blast furnace ironmaking projects layout

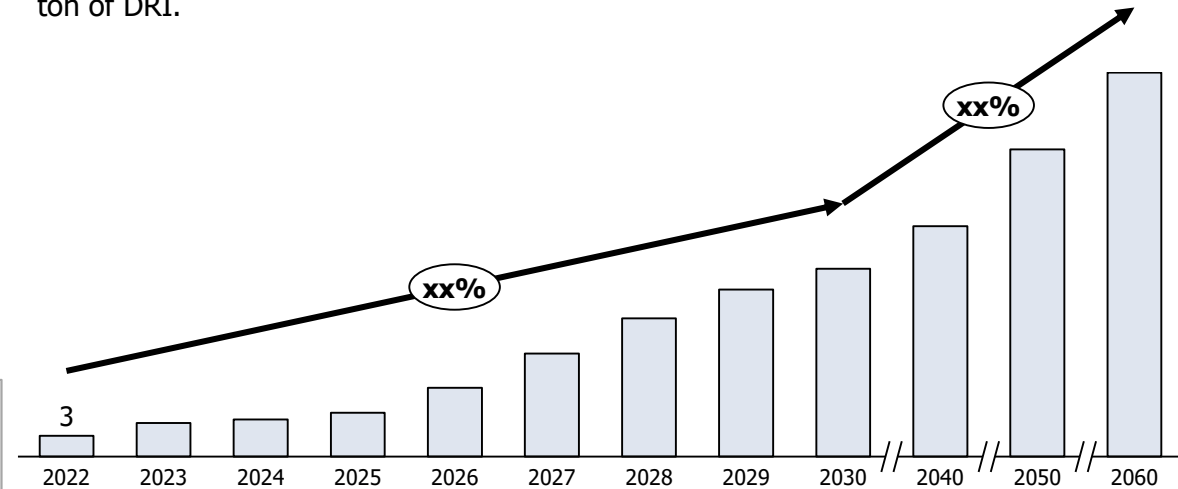


Note: SRI, smelting reduction iron technology, includes HIs melt, COREX, CISP, etc., DRI, directed reduction iron technology, includes Midrex, HYL, etc. Currently, China's DRI all uses HYL technology.

The Chinese steel company HBIS Group Hebei Zhangxuan Hi-Tech Technology Company (HBZX High Tech) has successfully produced an industrial batch of direct reduction iron (DRI) using Energiron technology, which involves enriching coke gas with hydrogen by more than 60% since May 2023.

This cutting-edge facility, equipped with a **600,000** metric ton-per-year Zero Reformer Energiron® direct reduction plant, has successfully achieved continuous, stable, and safe production with exceptional quality.

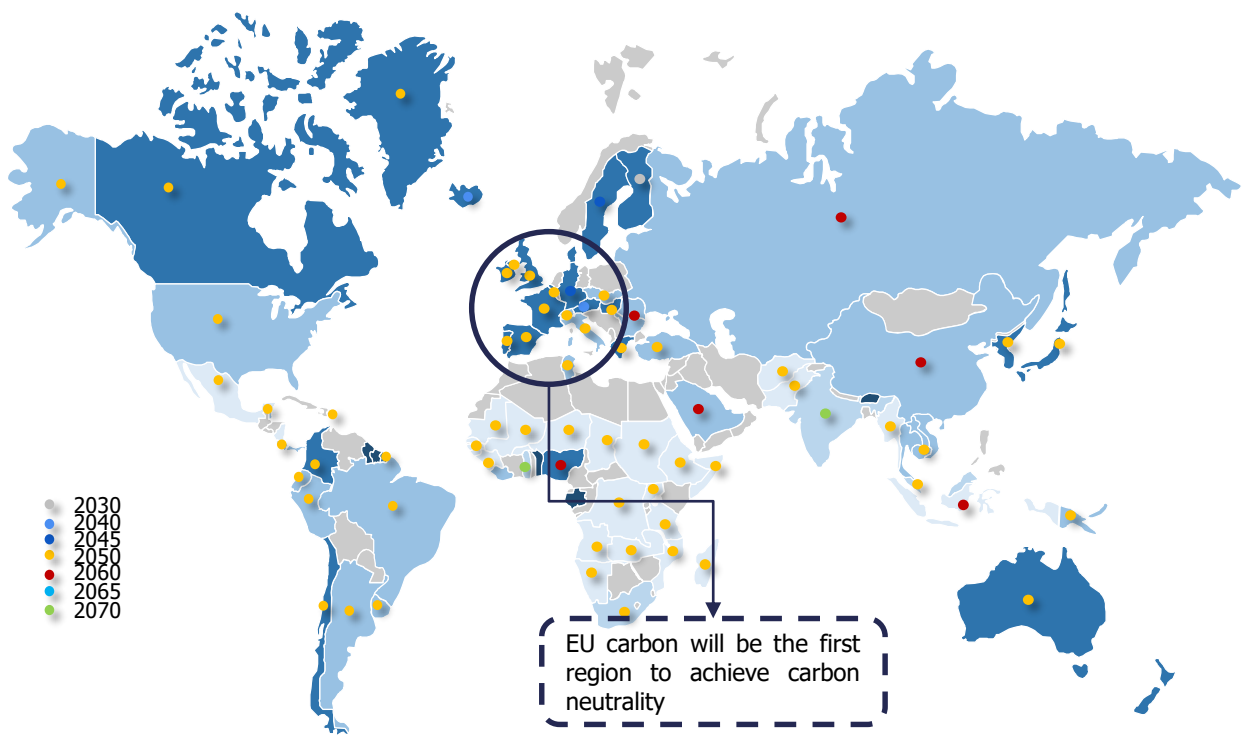
With a remarkably low CO2 release of only **250** kg per ton of DRI, the HBIS plant stands as the greenest industrial DRI facility globally. Furthermore, the facility incorporates a CO2 removal unit within the Energiron® process scheme, enabling selective recovery of carbon dioxide. This paves the way for potential carbon capture and use or storage (CCU/CCS) initiatives, leading to a net emission of only approximately **125** kg of CO2 per ton of DRI.



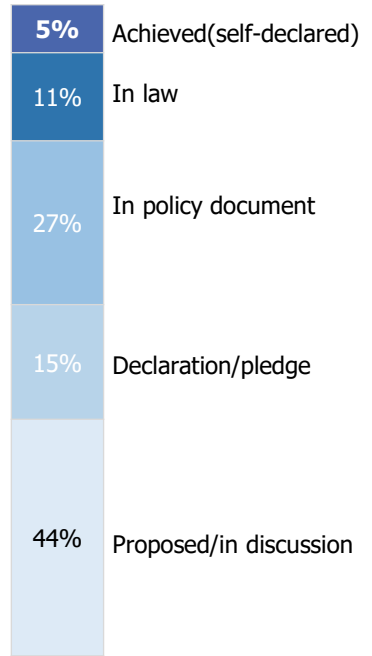
DRI capacity evolution

The introduction of the CBAM mechanism and the increase in the cost of CO2 emission quotas will make pig iron uncompetitive with HBI/DRI

➤ Overview of global decarburization process

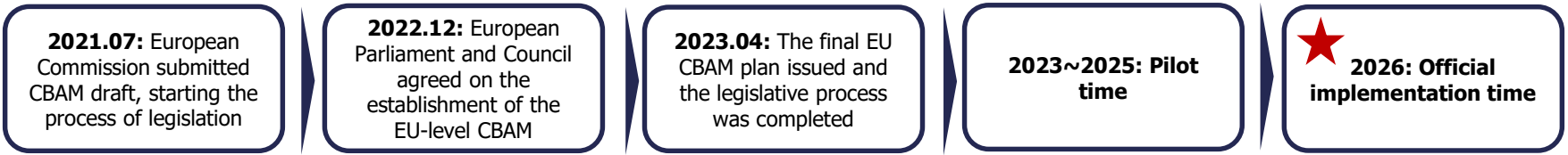


Note: countries in gray haven't announced the net zero emission target.

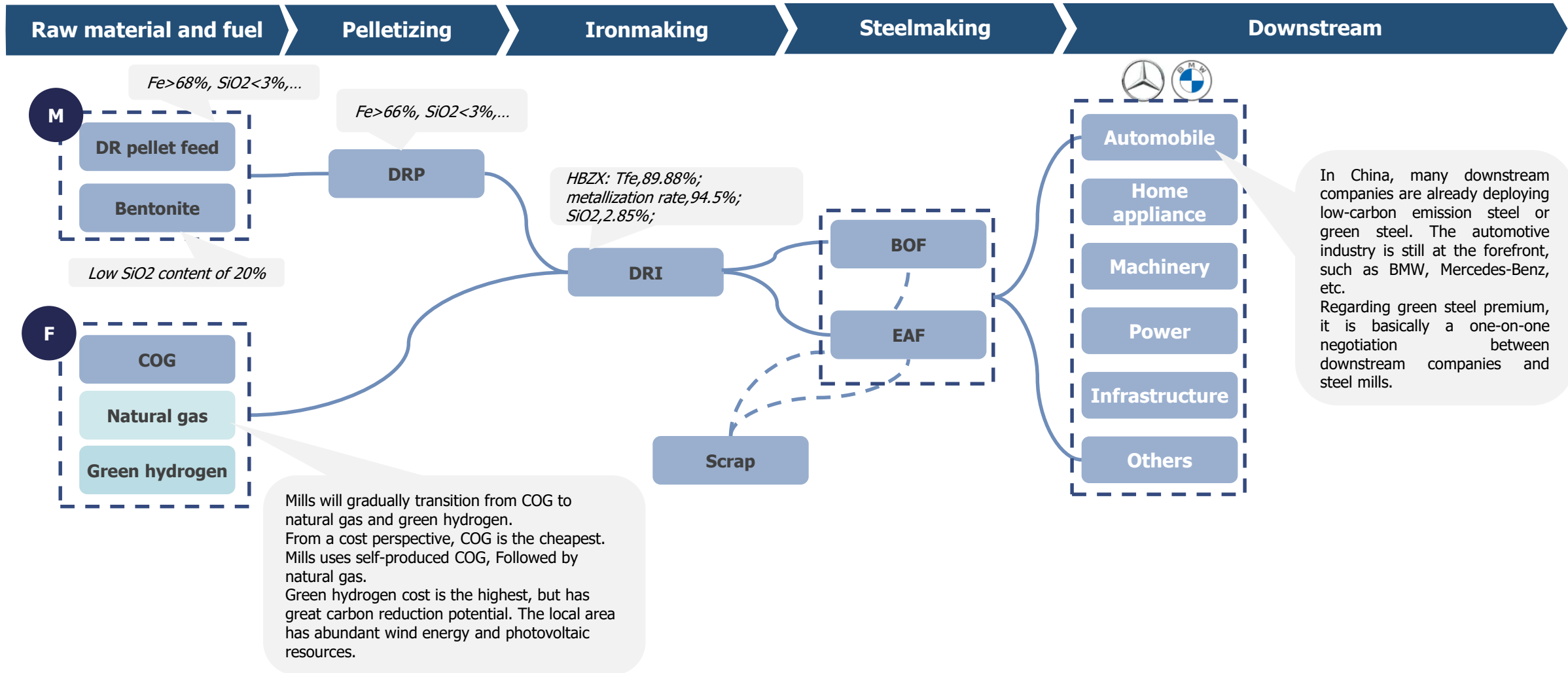


- The European Union's implementation of a Carbon Border Adjustment Mechanism (CBAM) to reduce the risk of carbon leakage as it strengthens its Emission Trading System is likely to push consumer prices higher and affect metal trade flows. It will also force producers globally to accelerate efforts to cut their carbon footprint.
- Experts proposed that a low-carbon green steel product market should be created outside the traditional steel market. In this market, green steel should be priced at a certain premium, that is, the price is higher than that of traditional steel products. Of course, the premise is that downstream users accept the premium.
- The introduction of the CBAM mechanism and the increase in the cost of CO2 emission quotas will lead to an increase in the price of pig iron. This will make pig iron uncompetitive with HBI/DRI. HBI/DRI is a more environmentally friendly raw material.

➤ Timeline and main content of CBAM plan



Large steel companies have launched environmentally friendly DRI layout, reducing their carbon footprint



In China, many downstream companies are already deploying low-carbon emission steel or green steel. The automotive industry is still at the forefront, such as BMW, Mercedes-Benz, etc. Regarding green steel premium, it is basically a one-on-one negotiation between downstream companies and steel mills.

HBZX High Tech has successfully produced an industrial batch of DRI using Energiron technology since May 2023



HBZX



Location: Xuanhua, Hebei
Method: ENERGIRON
DRI Capacity: 0.6 million tons
Fuel: COG
Production year:

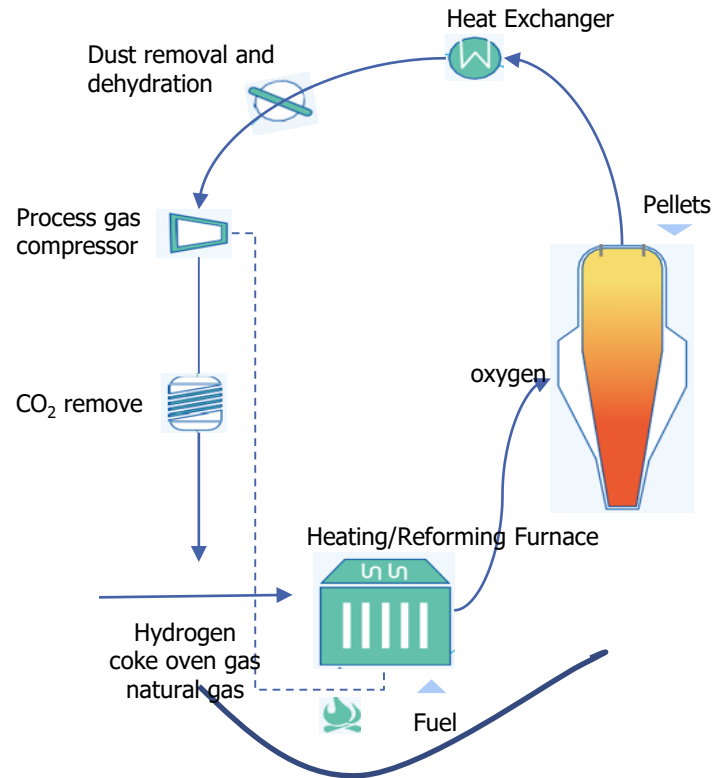
- The capacity of plants are 0.6 Mtpa, and put into operation in May, 2023. And phase II will put into operation in 2024.

DR pellet source:

- Self-produced. The pellet capacity of Xuanhua plants is 2.2 million tons.

DR pellet feed source:

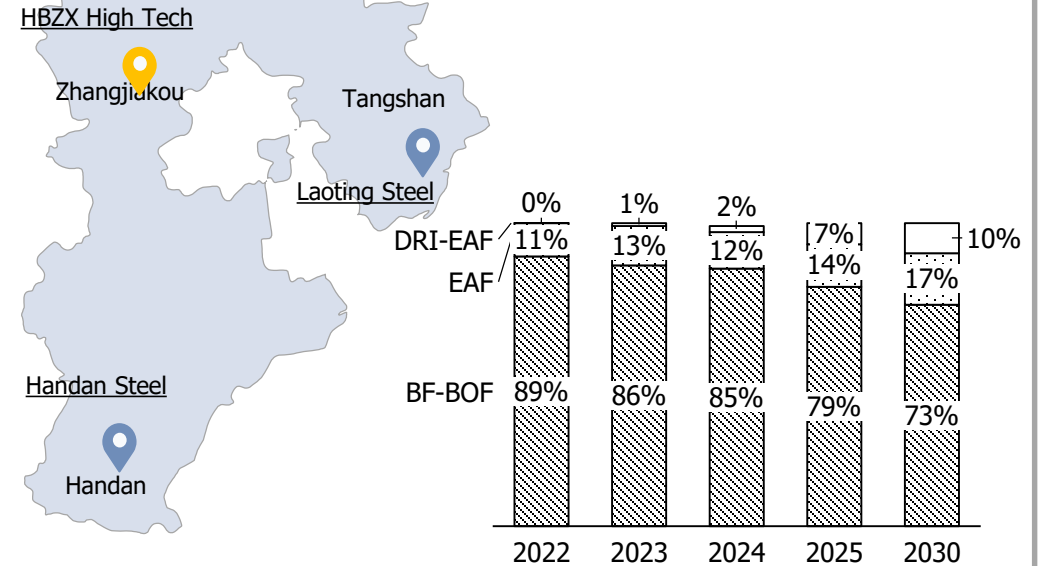
- DR pellet feeds mainly from Hebei and Shanxi province. domestic for adequate supply of local concentrates. Local concentrates can be processed into DR pellet feeds.



DRI production process

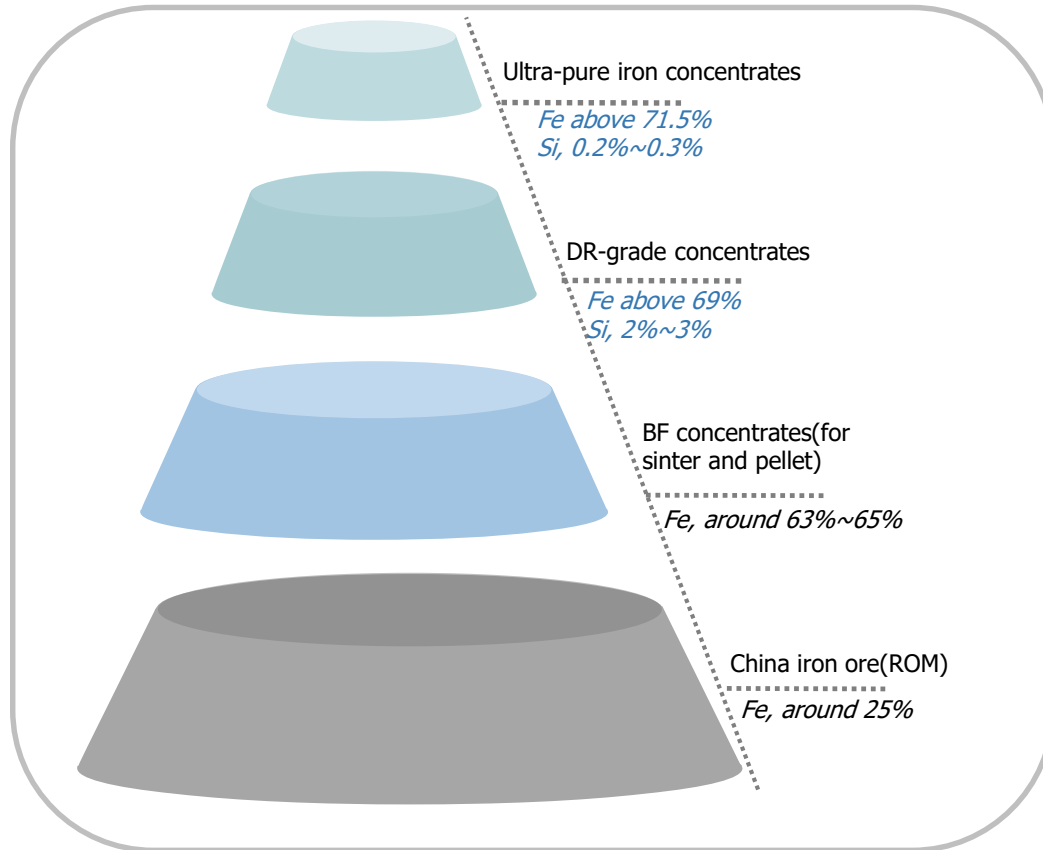
HBIS DRI projects plan and future capacity plan

At present, HBIS has EAF capacity of 6 million mt and DRI-EAF capacity of 0.6 million mt. It's expected that BF-BOF steelmaking will be reduced to 73%, EAF will reach 17%, and DRI-EAF steelmaking share will be 10% by 2030.

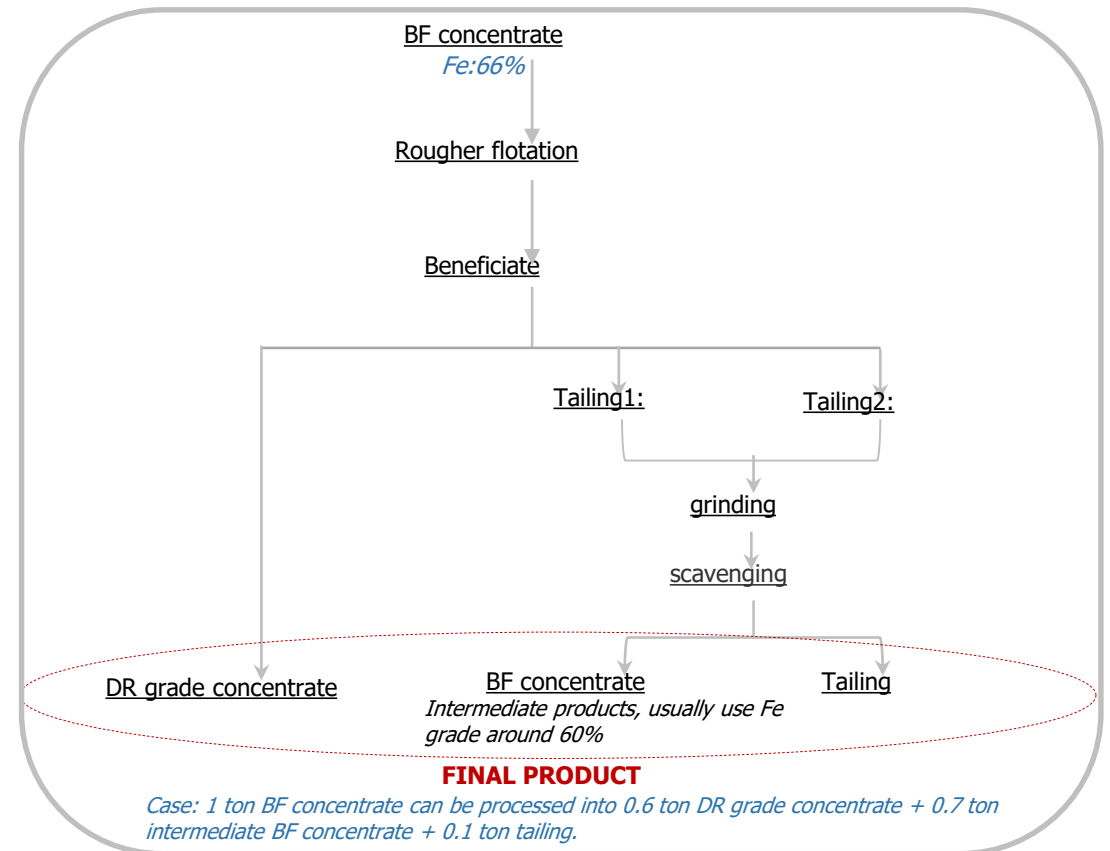


Small amount of China BF concentrate may be produced into DR pellet feeds after grinding and beneficiation again

➤ Chinese iron ore classification(4-level)

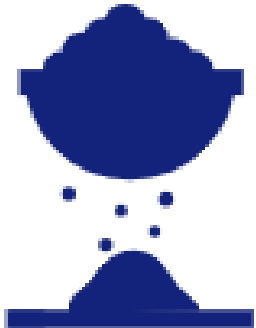


➤ How BF concentrate is processed into DR grade products?



- ✓ Currently, almost no mines in China produce DR concentrates because no buyers. However, some mines have taken the lead in experimenting with the production of DR concentrates.
- ✓ When BF concentrates are processed into DR pellet feeds, it generally needs to go through grinding and beneficiation again.

In the future, perhaps only a small number of mines in China may produce DRPF



DR pellet feeds

1

How to calculate the VIU for DR pellet feeds?

- *How to calculate the intermediate products value?*
- *How much of processing cost?*
- *How much of tailings disposal cost?*
- *What's the main influence factors?*
- *How to pricing final DR pellet feeds?*

2

China mines are qualified to produce DR pellet feed?

- *Fe grade*
- *Si, Al, P, S...For example, The lower the silicon content, the better. China concentrates generally have high silicon content, some as high as 10% or more. Only a few concentrates with low silicon content can be used to produce DRPF.*
- *Ore body*
- *Particle size*
- *...*

3

Can China's overseas equity mines supplement the shortage of DR pellet feeds?

- *China overseas equity mines volume?*
- *How much can be processed into DR pellet feeds?*
- *Detail analysis of large overseas equity mines such as Simandou, Peru iron ore, Sino Iron, etc?*

4

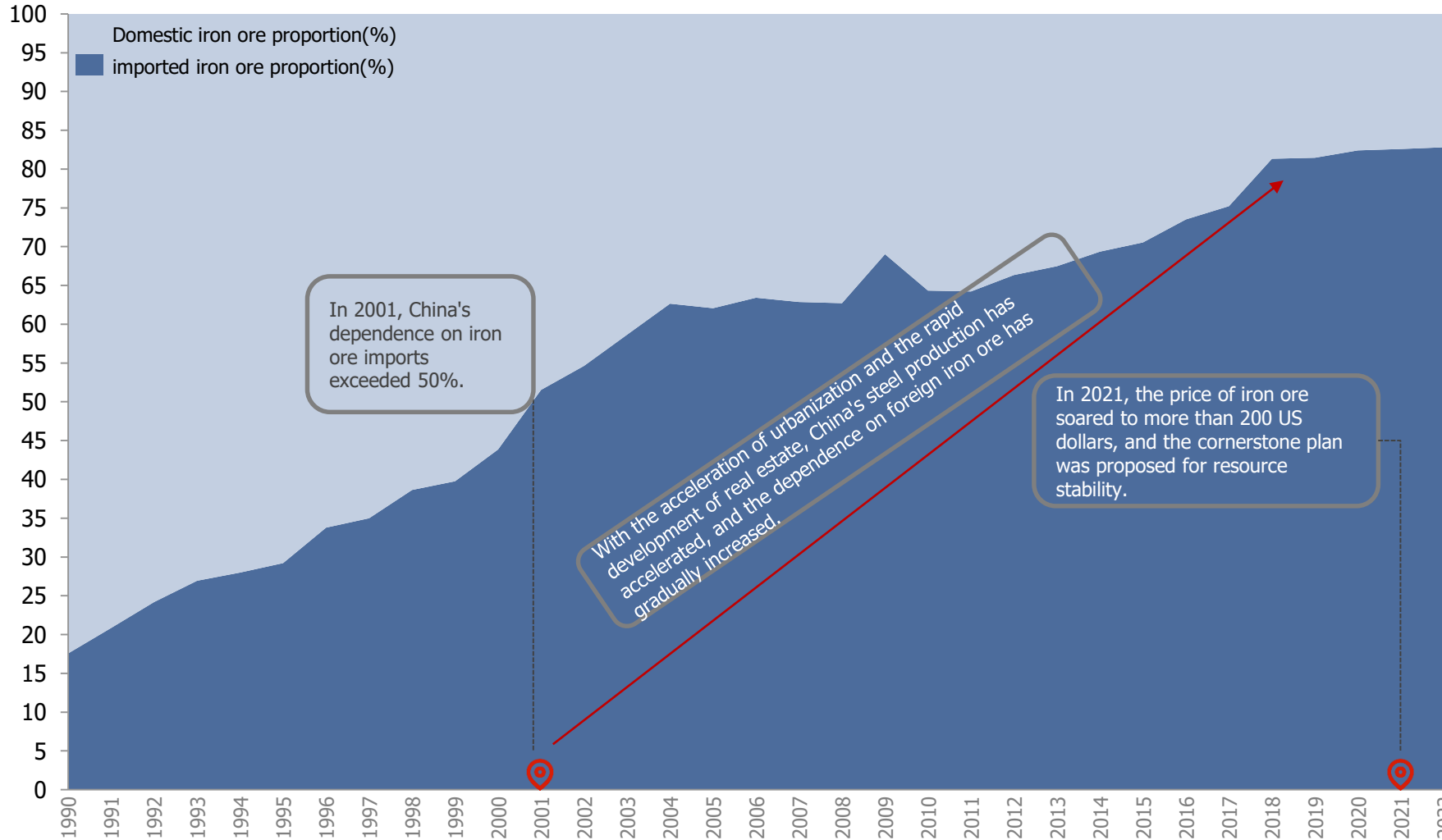
Other factors that should be considered?

- *The capacity of China iron ore mines becomes fully utilized. Even with the encouragement of the Cornerstone Plan, it is difficult to significantly increase the supply of concentrates in China, mainly considering the depletion of existing resources.*
- *How about the progress of HIs melt technology? This technology can use low-grade ores such as PB fine, Newman fine, etc. Molong company is promoting HIs melt technology nationwide and overseas.*
- *How will China concentrate split in the future? for sinter feed? for pellet feed? for DR pellet feed? or for Ultra-pure iron concentrates?*

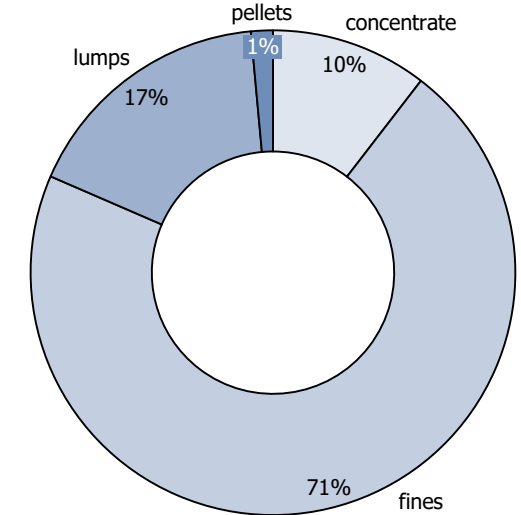
Source: SMM

Imports of clean iron units such as DR grade concentrates, DR grade pellets, and DRI will increase

➤ China's dependence on imported iron is as high as 80%



➤ The average iron grade of China's imported iron ore is 61%~62%



China's total annual iron ore demand is as high as 1.3 billion tons, of which more than 80% depend on imports.

Currently, China's imported iron ore is dominated by fines and lumps, with concentrates and pellets accounting for only 11%. The average Fe grade is around 61%~62%.

With the deepening of decarbonization, China's vast steel market will greatly increase the demand for clean raw materials. It is expected that China's iron import pattern will also change accordingly, that is, imports with an average grade of 61%~62% will decline, and imports of clean iron units such as DR grade concentrates, DR grade pellets, and DRI will increase.

Global layout of China DRI/SRI and DRI pellet feeds

➤ Global layout of China's DRI/SRI and raw materials

