China ultra-low emission steel production & industry relocation analysis

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INTRODUCTION:

- The iron and steel industry has been known as an industry that is difficult to achieve deep emission reduction. It is significance to analyze the feasibility of ultra-low emission steelmaking technology for China to achieve the goal of carbon neutrality.
- This study integrates the AIM/Enduse model and calculate the minimum cost of different technologies to analysis steel industry zero CO2 emission pathway in China.

METHODS:

We adopt AIM/Enduse to establish China provincial steel production technology economic model. 3 technologies (table1)are chosen to produce zero emission steel in China.

Key factors impact total cost of zero steel:

- Raw material cost (Iron ore, domestic & imported)
- Transport of Iron ore: 10-15 USD/ton
- Energy cost (renewable energy)
- Technologies development

Table 1 steel technologies

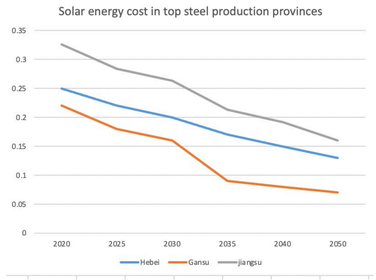
Energy	technologies	code
coal	BF +Carbon capture	BFCCS
Green Hydrogen	H2 based direct reduction of iron	H2DRI
Electricity (renewable energy)	electric furnace steel	EFS

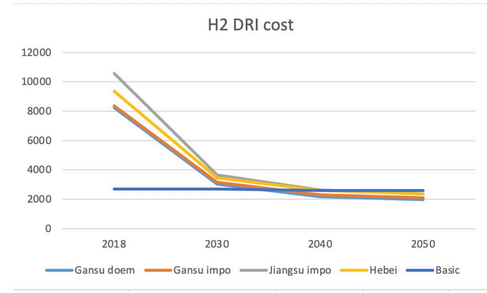
Table 2 The assumption scenarios design

Scenario	Note
REF	Business as usual
ELE	Ultra low emission technologies involved

Result & Discussion:

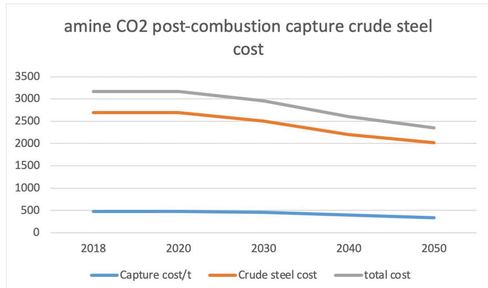
（1） H2 DRI cost in different regions

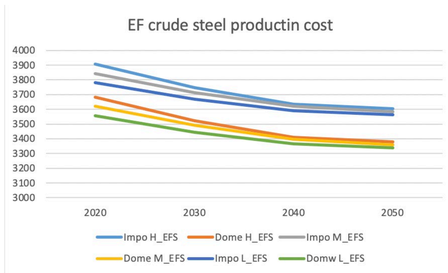




- Renewable energy will replace the traditional coal as the energy supply for the steel manufacturing industry, and the power cost required for hydrogen production and electric furnace steel will be extremely increased. In the future, areas with good lighting conditions such as the western region have great potential to develop zero carbon steel. As shown in the figure above, the DRI cost in Gansu Province in 2032 will be lower than the traditional steel-making cost.

(2) BF-Carbon capture & EF crude steel production





- Applying carbon capture on BF can reduce about 70% of total emission in steel production. With the technology development, energy efficiency gradually improved, and the emissions in the remaining steps will also be reduced.
- The cost of EF steel is mainly due to the high price of imported scrap steel and the shortage of local scrap steel supply in China. The accumulated amount of scrap steel produced in China can be reported to the proportion of electric furnace steel output in China in the short term (2025 15%).