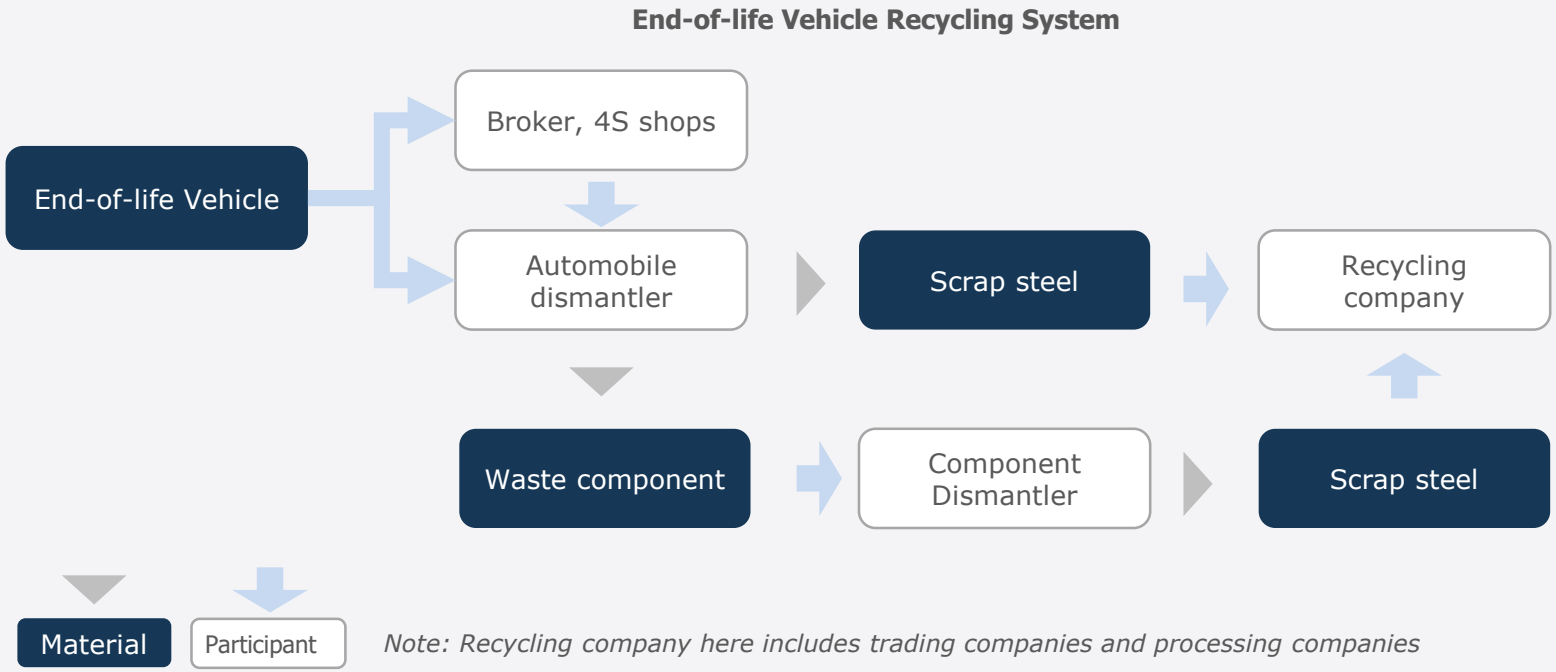
05 China Scrap Steel Cost Curve

Typical Flow of Obsolete Scrap Steel from automobile

Cost breakd own

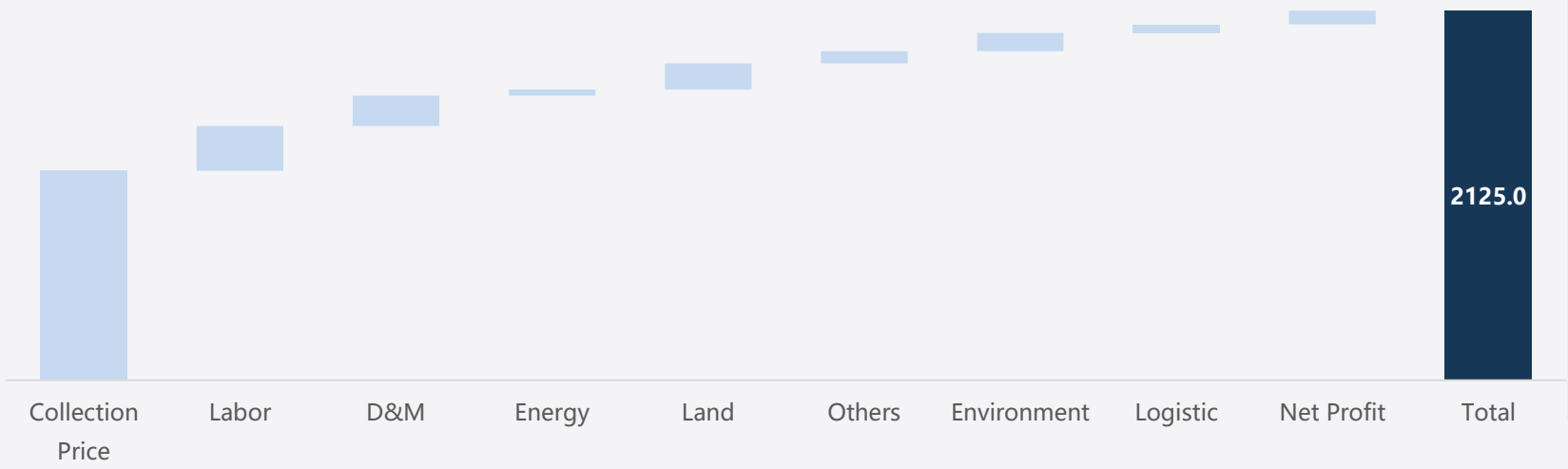


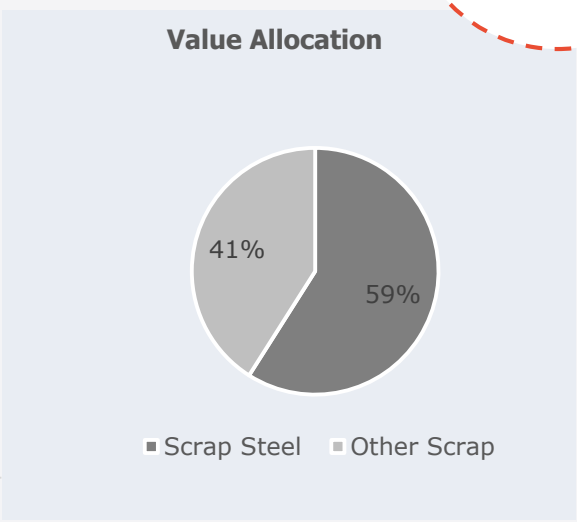
- Many ELV dismantlers have their own collection teams to directly purchase ELV from end-users, while some of them also purchase from brokers or 4S shops;
- There are two channels for the collection of obsolete scrap automobiles, and recycling from automobile dismantler directly is the main source of the automobile scrap steel.
- ELV dismantlers should obtain license from the government. Due to the high residual value of ELVs, there are many unlicensed players without approval. The proportion of unlicensed dismantlers is about 50%. Unlicensed dismantlers usually have lower environmental protection and tax costs, and can pay higher prices to collect more ELVs. Meanwhile, they can sell the high-value components to the second-hand market for higher profits. In the past two years, China has also issued a series of management measures for the recycling of end-of-life vehicles to supervise and improve the vehicle recycling system.

Average Value Allocation — Automobile Scrap

Cost breakd own

Unit: RMB/Vehicle Automobile scrap, excl. VAT





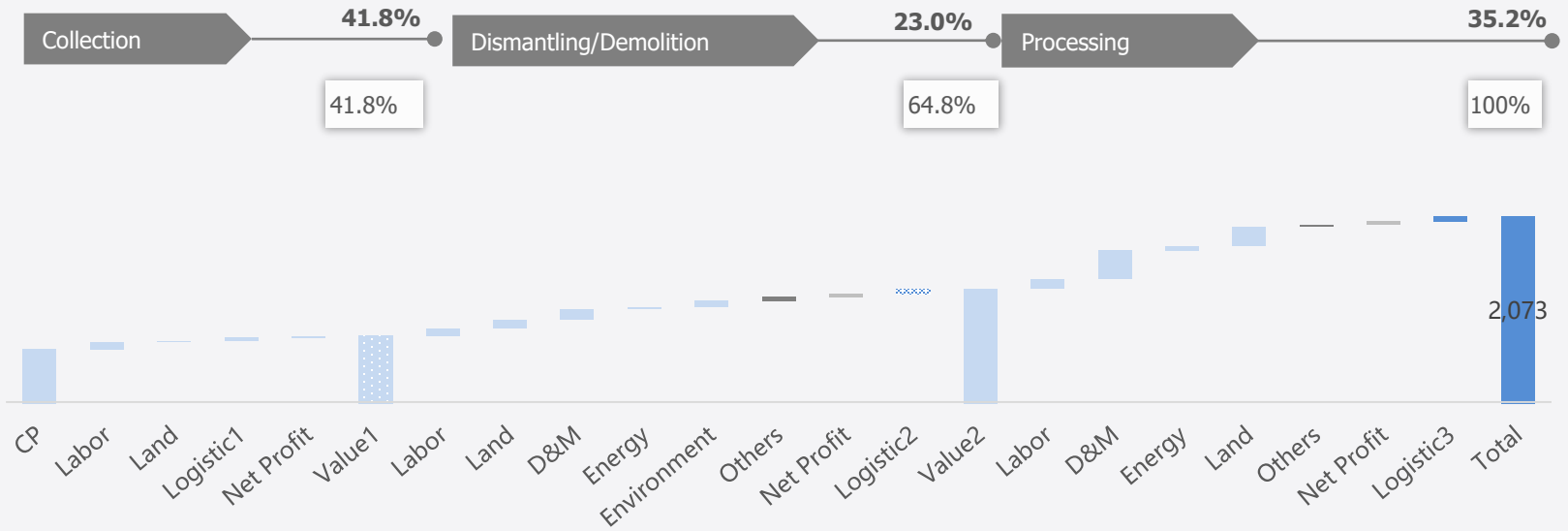
Note: 1. The value allocation is the weighted average level of passenger car and commercial car
2. Others include sales expenses, financing expenses, management expenses and all other costs

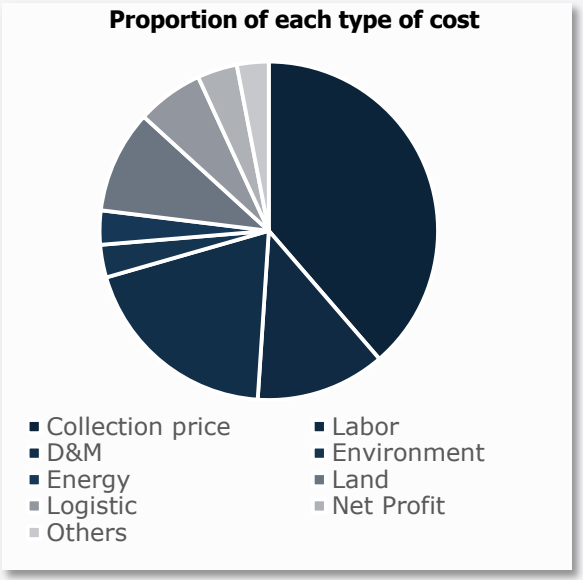
- The above price refers to the cost of dismantling each vehicle. With the release of a series of policies such as the opening-up and reengineering of the five major automobile assemblies, the recycling price of end-of-life vehicles is also rising rapidly.
- But even though the five assemblies (incl. engine, steering, gearbox, front & rear, and car frame) are allowed to be remanufactured since Sep. 2020, most of these parts still end in scrap rather than in being remanufactured for licensed dismantlers. Therefore, the current proportion of other scrap still is low, but it is likely to contribute more value in the future once the remanufacturing system become more mature and customers become more open-minded to remanufactured parts.

Cost Breakdown of the Obsolete Scrap Steel from automobile

Cost breakd own

Unit: RMB/ton scrap steel, excl. VAT





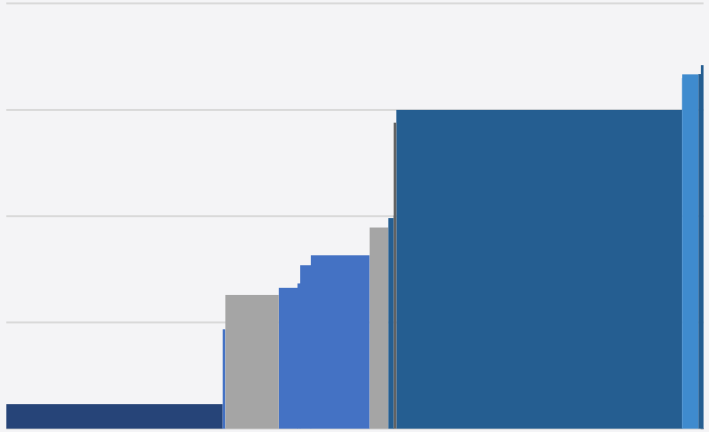
Note: 1. The cost is the weighted average recycling cost of the scrap from of passenger car and commercial car
2. Others include sales expenses, financing expenses, management expenses and all other costs
3. Logistic[1] is occurred from collection station to processing co.; logistic[2] is occurred from dismantling co. to processing co.; logistic[3] is occurred from processing co. to steel mills

- On the whole, most of the cost in automobile recycling comes from the collection and dismantling links, accounting for 64.8% of the total, mainly because the recycling price of automobiles has risen rapidly in the past two years. At the same time, due to the increasing mechanization of dismantling, the processing plants use a large number of mechanized dismantling equipment and processing equipment, and their costs also account for a large proportion.
- Meanwhile in recent years, the government has high requirements for environmental protection, and the oil pollution and hazardous waste need to be treated in the process of automobile disassembly, resulting in the rapid rise of environmental protection costs; The processing segment accounts for 35.2% of the total cost, mainly include the equipment depreciation and maintenance costs caused by the crushing of automobile scrap.

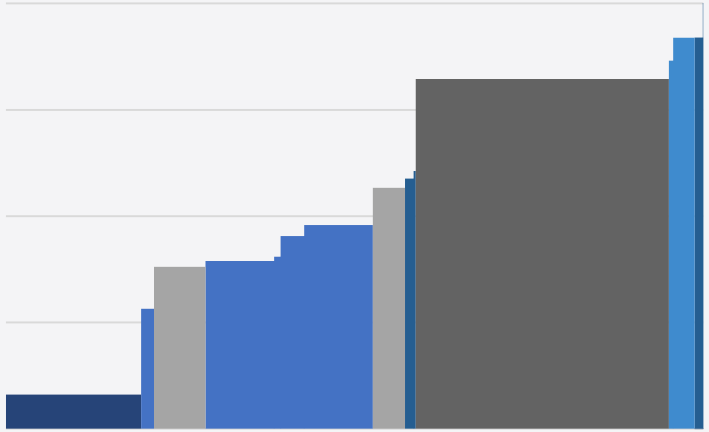
Scrap Steel Cost Curve

Shanghai Metals Market

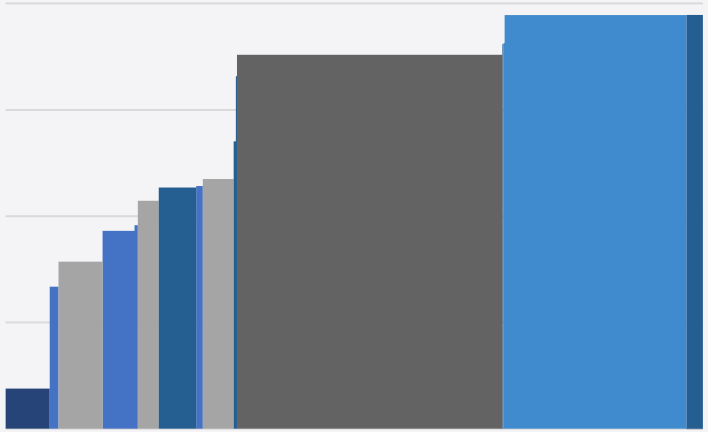
Scrap processing costs of various industries in 2021

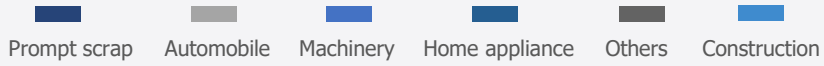


Scrap processing costs of various industries in 2030(E)



Scrap processing costs of various industries in 2050(E)





Notes:

1. The vertical axis represents the cost, unit: USD/ton, VAT excluded;
2. The horizontal axis represents the scrap output, unit: mil. Tons.
3. **The cost comparison does not include the collection price and profits.(Which is equivalent to recovery cost, plus disassembly cost, plus processing cost)**
4. **The impact of CPI is not considered**

- The total cost of scrap steel consists of recovery cost, disassembly cost and processing cost. Through research we know the total cost of dismantling waste materials from different industries and the costs of various links. Then the comprehensive cost is calculated by the proportion of scrap steel in each scrap product and the number of scrap products needed to get each ton of scrap steel;
- Prompt scrap can be directly put into the furnace due to its high quality, So its recycling price is generally very high but its processing is very simple and the cost is very low(So in the figure we can see the cost of prompt is very low). At present, scrap yard generally cooperates directly with mechanical processing enterprises. While recycled the prompt scrap directly, they can also recycle more scrapped mechanical equipment.
- From obsolete scrap side, the ranking of cost will not change a lot, however, for those industries that require a lot of labor in the recycling, disassembly and processing processes or will produce greater pollution, the processing cost will still rise.

Cost forecast methodology

Shanghai Metals Market

➢ Key factors affecting scrap steel cost

Item	Trend	Assumption
Labor	↓ ↓	• Declining factors: The group of the development research center of the State Council: "the labor force in the secondary industry will drop from 200million in 2020 to 160million in 2030". At the same time, considering the improvement of mechanization rate, it is expected that the labor cost will be reduced.
Energy	↑ ↓	• Electricity charge: In the future, the access threshold for power generation and consumption will continue to be lowered and the market system will continue to be improved. The proportion of electricity whose price is determined by the market transaction method will maintain a rapid growth, and the electricity charge will decline; If the industrial electricity price is further reduced, the demand for industrial electricity will rise, which will lead to a sharp increase in carbon emissions on the power production side, which is contrary to the macro goal of carbon emission reduction. On the whole, the electricity price shows an upward trend. Referring to the prediction of the total industrial output value in 2030, **it is expected that the electricity price will increase by an average of 3%. With the large-scale use of clean energy, the forward electricity price will remain stable and decline slightly, with a prediction of -0.3%**; • Fuel cost: the application of new energy makes the overall fuel cost basically stable; It will decline steadily in the long term.
D&M	↑ ↓	• **Growth factors**: In order to improve the degree of mechanization, equipment investment increased rapidly; Referring to the GDP growth rate, 2021-2030:5.4%, 2030-2045:2.3%, it is predicted that the fixed asset investment will increase by 5% and 2% respectively; • **Declining factors**: the degree of mechanization has increased, the disassembly volume and processing volume have increased, and the shared depreciation cost has decreased, with a forecast decrease of 5% and 3% respectively.
Land	↑ ↑	• **Growth factors**: 1. Since 2021, the state has issued a series of supporting policies, strengthening the demand for enterprise plants. The index of industrial land is largely occupied due to agricultural and real estate development, the new industrial land is less and less, and the stock of industrial land is also more and more scarce, resulting in the increasingly scarce supply of industrial plants. In the case of short supply, the value of the plant will rise further. 2. National Land Planning Outline: control production space, reduce the proportion of industrial land, and improve the input-output benefits of industrial land; • **Reducing factors**: The amount of disassembly increased, and the shared cost decreased, but it was not enough to offset the rising trend.
Environment	↑ ↑	• The increasingly strict environmental protection supervision will further increase the investment in environmental protection costs of enterprises. With the accumulation of investment costs, the investment will continue to grow, but the growth rate will gradually slow down.
Others	↓ ↓	• It mainly includes administrative expenses. With the improvement of the recycling system, **it is expected that the administrative expenses of recycling and processing enterprises will decline.**
Profit	↑ ↑	• The standardization of the industry, the improvement of the scrap ratio of steel mills and the improvement of the degree of processing mechanization have further increased profits. The overall profit will recover to 5% by 2030 and 8% by 2050. **The profit margin growth in 2030 and 2050 are: front-end recycling: 5.4%, 4%, and back-end processing: 3.5%, 2.5%.**
logistic	↑ ↓	• Rise first and then fall. The logistics industry is mainly composed of transportation costs (driver, stevedore and other labor costs, vehicle fuel costs, depreciation costs, tolls, etc.), storage costs, management costs (travel expenses, conference fees, communication fees, management information system fees and other miscellaneous expenses incurred by enterprises for logistics management). With the growth of transportation costs, it is expected to increase by an average of 8% by 2030. Subsequently, the management cost will fall rapidly, with an average decrease of 1% by 2050.

Notes: The left arrow represents the trend from 2022 to 2030, and the right arrow represents the trend from 2030 to 2050

Cost forecast methodology

Shanghai Metals Market

➢ Key factors affecting scrap steel cost

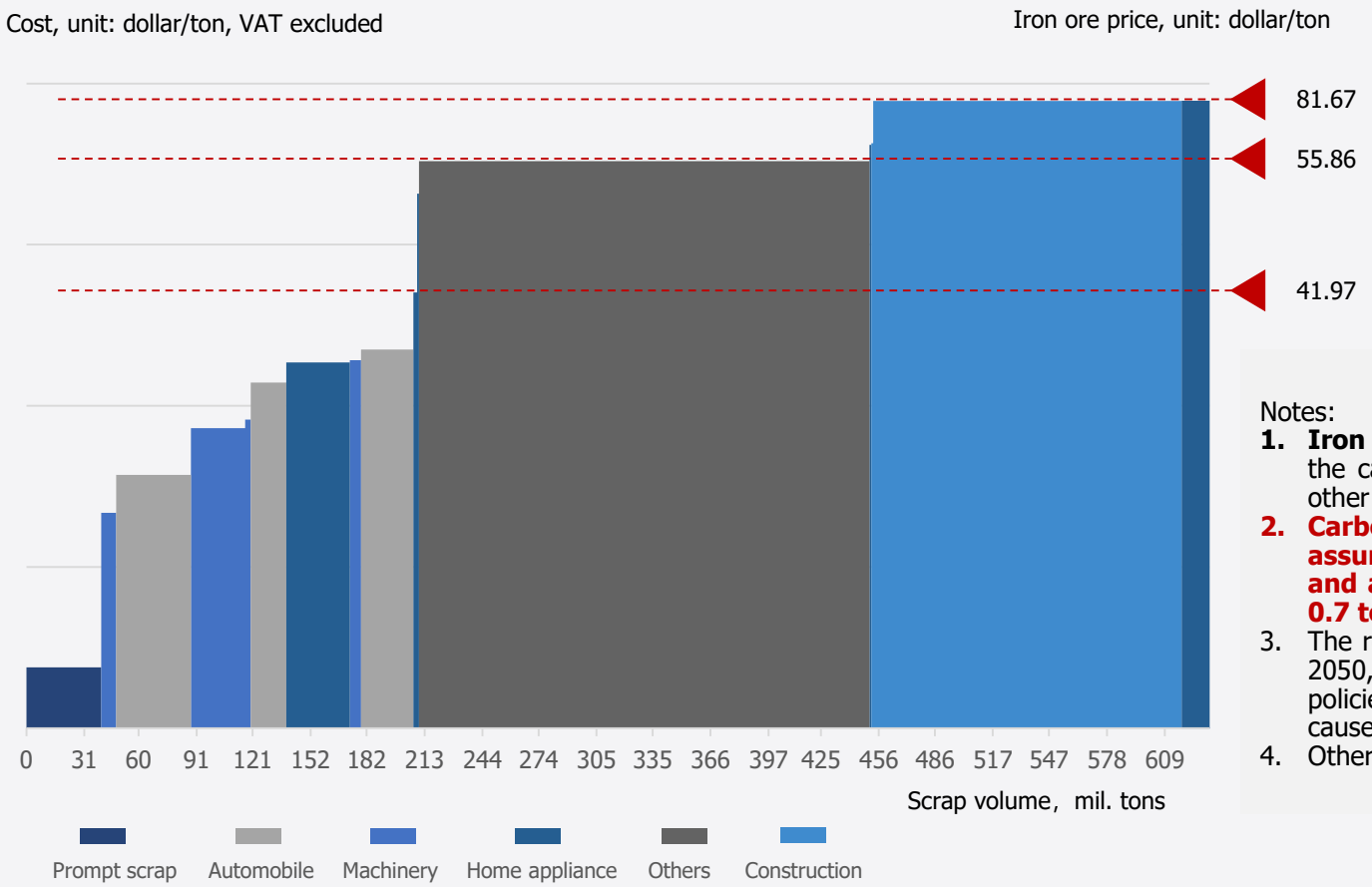
Item	Trend	Assumption
Construction	↑ ↑	• Generally, building demolition does not require demolition costs, and the demand for building demolition will increase year by year, and the recycling price will basically remain stable and increase slightly;
Automobile	↑ ↑	• By 2030, the overall scrap volume will rise. Due to environmental protection and other factors, it is expected that there will be no significant growth in disassembly enterprises. The growth rate is mainly based on CPI; • After 2030, the recycling system will be gradually improved, and the number of scrapped cars will further increase, which will narrow the increase of recycling price.
Machinery	↑ ↑	• Due to the high quality of scrap steel in the machinery industry and the shortage of related resources, the proportion of recycling in the machinery industry is decreasing year by year, and its recycling price is expected to maintain a stable growth;
Home Appliance	↑ ↑	• Scrap yard mainly recycles non-ferrous metals in household appliances. The overall scrap volume of household appliances increased. With the improvement of the recycling system, the short-term recycling price increased slightly; However, due to the long disassembly process and the gradual reduction of subsidies, it is expected that the disassembly capacity will not increase significantly, and the price will increase significantly;
Others	↑ ↑	• Mainly considering the impact of supply and demand, the recovery price rises rapidly in the short term; In the long run, the supply of scrap steel will be gradually restructured, and the price will basically remain stable in the future;
Prompt scrap	↑ ↑	• With the progress of processing technology, the production of prompt scrap will be further reduced. Its change trend refers to the CPI forecast and is consistent with the trend of obsolete scrap, which will increase by 1.5% and 1% respectively by 2030 and 2050.

Notes: The left arrow represents the trend from 2022 to 2030, and the right arrow represents the trend from 2030 to 2050

Sensitivity of scrap supply to fluctuations in iron ore prices

Shanghai Metals Market

➢ Sensitivity of scrap supply to fluctuations in iron ore prices in 2050



- By 2050, if the price of iron ore reaches 81.67 dollars/ton, the price of pig iron will be equal to the maximum cost of scrap steel.
- By 2050, if the price of iron ore decline to 55.86 dollars/ton, only about 70% scrap steel is expected to be used.
- If the price of iron ore decline to 41.97 dollars/ton, only about one-third scrap steel is expected to be used.

Notes:

1. **Iron ore price**: This assumption only considers the price change factors of iron ore and the carbon tax while ironmaking and steelmaking , and assumes that the costs of all other influencing factors remain unchanged.
2. **Carbon tax: Assuming a carbon tax of $60 60/ton of CO_2 is generated. And we assume that the production of each ton of pig iron produces 1.5 tons of CO_2, and a carbon tax is $90; The production of each ton of crude steel produces 0.7 tons of CO_2, and a carbon tax is $42;**
3. The recycling price of scrap steel is not considered. Therefore, there is a possibility: by 2050, due to rising processing costs and the huge pressure of environmental protection policies, some industries may need to pay scrap yard to process scrap steel. This may cause the scrap price to be lower than the processing cost;
4. Others mainly includes infrastructure&transportation, shipbuilding and others.