

WANG Minxi, GU Shanlu and GUO Yan, 2014. Steel Scrap's Discovery and Utilization: Based on China. *Acta Geologica Sinica* (English Edition), 88(supp. 2): 1294-1295.

Steel Scrap's Discovery and Utilization: Based on China

WANG Minxi, GU Shanlu and GUO Yan

College of Management Science, Chengdu University of Technology, Chengdu 610059, China

1 Introduction

Steel, which is an importantly basic mineral resource in the national economic construction, is widely used in ship, automobile, estate, manufacturing and other industries. Since 1990, with the speeding up of China's industrialization, the steel demand in China increased rapidly. The high quantity demand promoted the crude steel production growth significantly. In 2008, China's crude steel outputs are up to 500 million tons, it is five times of the out puts of 1996. China became the largest country of the crude steel production in the world. In terms of the structure of the materials, the iron ore and scrap steel are two main raw materials to produce steel. The scrap steel in crude steel production can greatly reduce the exploitation of iron ore and energy consumption. According to statistics, using scrap steel to produce 1 ton of crude steel could reduce 4.3 tons of iron ore mining, and save energy 60%, save water 40%, reduce exhaust gas emissions 86%, reduce waste water discharge 76%, reduce waste emissions 97% (Zhou, 2013; Zhou et al., 2013). Scrap steel has become an important alternative source of iron ore. So there are important academic value and practical significance in forecasting and analysis the scrap steel consumption in China.

2 Methods, Data and Analysis

2.1 Methods

In this paper, we use curve-fitting method to analyze data, and then use least square method to operate by MATLAB. The purpose is to fit the trend curve function by analyzing history data and predict the future demand for scrap steel in China.

2.2 Data

In this paper, we collect the data of scrap steel consumption in China from 1990 to 2012, and the average price of imports' iron ore in China from 2000 to 2012, and the amplification of imports' iron ore in China from 2001 to 2011. All of them are used to analyze scrap steel consumption trend in China.

2.3 Analysis and model

From 1990 to 2012, China's scrap steel consumption increased about 300%. This paper fit the curve of Chinese scrap steel consumption during the past 13 years and receive the fitting polynomial function of time series. X stands for time (year), Y stands for the consumption of scrap steel (megaton). The following is the formula (1).

$$y = -0.003x^4 + 0.1494x^3 - 1.9419x^2 + 9.2176x + 15.309 \quad (1)$$

The results are showed in Fig. 1, China's scrap steel consumption is in line of "s" shape. This is consistent with the trend of global scrap steel consumption (Chen et al., 2010; Bertram et al., 2002; Timo and Jost, 2014). China's scrap steel consumption is expected to increase dramatically in the future.

According to the average price of iron ore imported in China from 2000 to 2012, it indicates that the price of imports' iron ore has increased 500%. In the past 12 years. As it is shown in Fig. 2. x stands for time (year), y stands for the average price of iron ore imported in China (dollar). The high price dramatically increase the cost of China's steel production and gradually reduce the amplification of Chinese iron ore imports. The biggest decline is up to 104%. Fitting the growth curve of Chinese imported iron ore during 2001 to 2011 and getting a fitting polynomial function in time series, which is shown in Fig. 3. x stands for time (year), y stands for the amplification of imports' iron ore as follow formula (2).

$$y = -0.001x^4 + 0.0037x^3 - 0.0347x^2 + 0.1182x + 0.1888 \quad (2)$$

* Corresponding author. E-mail: sallywang68@163.com

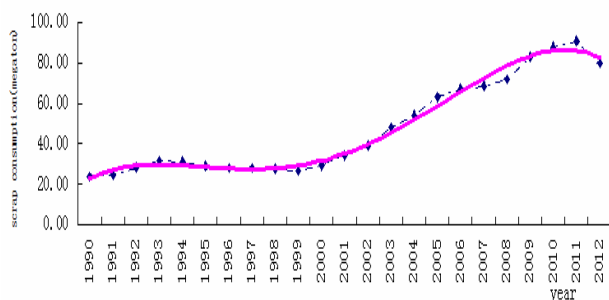


Fig. 1. The line chart of scrap steel consumption in China and the fitted line.

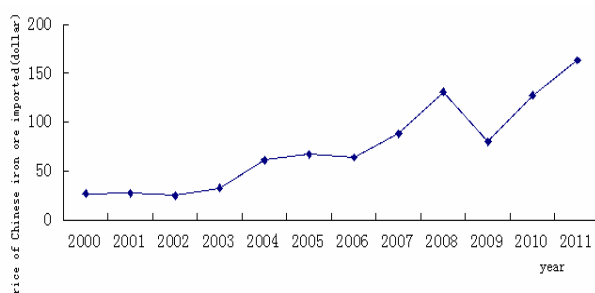


Fig. 2. The average price of iron ore imported in China.



Fig. 3. The import growth of iron ore and the fitted line.

The results from the curve fitting imply the quantity of Chinese imported iron ore being in a declining trend, which is predicted to keep the trends in the future.

Meanwhile, compared with the 35%–37% proportion in Japan scrap steel consumption of crude steel, this proportion in China is lower and still keep in a low level of 14%–27%, which is far below the developed countries'

level. The fact indicates that there is a huge space of scrap steel exploitation and utilization.

3 Conclusion

Based on the above analysis, the price of imported iron ore increased 500%. But iron ore consumption is decreased. China's scrap steel consumption grew to 300% in this decade. China is a country being in the later period of industrialization, crude steel demand will continue to increase in the future. Meanwhile, world's low carbon economy, China's energy conservation, emissions reduction and the environmental protection pressure, as well as enterprise production cost increase, all these factors will make Chinese scrap steel consumption continue to increase, so the scrap steel will become the main alternative raw materials of iron ore in steel production.

Acknowledgments

We thank the United States Geological Survey and China Nonferrous Metals Industry for their date and related information. We also thank all anonymous reviewers for their constructive comments and suggestions. We would like to thank Prof. Xin Li for his guidance and kind encouragement. This study was conducted as a part of the "Investigation and Evaluation of the Secondary Resource Utilization" and "Sichuan Mineral Resources Research Center (SCKCZY2011-YB018)" project, and was funded by the project.

References

- Bertram, M., Graedel, T.E., Rechberger, H., and Spataro, S., 2002. The contemporary European copper cycle: waste management subsystem. *Ecological Economics*, 42(1–2): 43–57.
- Chen Qishen, Wang Gaoshang and Wang Anjian, 2010. An Analysis of the Three Turning Points in the "S-shape" Rule of Copper and Aluminum Demand. *Acta Geoscientica Sinica*, 31 (5): 659–665 (in Chinese).
- Timo Heroth and Jost Wubbeke, 2014. *Challenges and political solutions for steel recycling in China*, 5(13): 208–231.
- Zhou Bin-yan, 2013. The recycling of metal waste and environment production, Chemical Industry Press, 13 (in Chinese).