Iron and steel stock in Austria – Bottom up analysis

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ABSTRACT: Iron and steel are important materials in construction and vehicle manufacturing but are also essential components of machines, tools or consumer durables. The use of steel scrap as secondary raw material substantially contributes to environmental protection by saving greenhouse gases in steel production and reducing iron ore depletion. It has economic benefits and reduces the dependency of imports. This paper provides a detailed analysis of the structure and sectoral breakdown of the iron and steel stock and permits a precise insight to what extent the future raw material supply can be secured through secondary raw materials. The results show a total anthropogenic iron and steel stock in Austria of 43.6 million tonnes or 5.2 tonnes per capita, whereby the different sectors contribute as follows to the overall stock: vehicle sector 17%, construction 52%, machinery 14% and metal ware 17%. These findings for iron and steel in Austria bounded in objects or items indicate a high potential for the use of steel and iron scrap.

Keywords: iron, steel, bottom up, stock, resources, anthropogenic, scrap, ore

1. INTRODUCTION

The iron and steel industry is one of the most important industrial sectors in Austria. The turnover in machine engineering and in working and processing of metal reached 43.8 billion € in 2012 (Statistik Austria, 2014) and the added value in the metal working industries accounts for 10% of the Austrian GDP. In 2010, about 15 million tonnes of products were exported (Eisenmenger et al., 2011) and 112,000 people worked in the iron and steel industry (WKO, 2015). Iron and steel are important materials, which are not only used in construction and vehicle manufacturing but are also essential components of machines, tools or consumer durables.

75% of iron ore as the required raw material for the production of steel has to be imported into Austria and imports will probably continously increase through the next decades (Krutzler et al., 2012, Weber and Heinrich, 2012). To reduce the dependency of imports, improved recycling measures and the greatest possible use of closed cycles will be important steps (Bartusch, 2013). In Germany, already 44% of crude steel is replaced by steel scrap (Wirtschaftssvereinigung Stahl, 2015). The use of steel scrap as secondary raw material substantially contributes to environmental protection by saving greenhouse gases in steel production and reducing iron ore depletion (Anderl et al., 2012, BDSV, n.d., Frischenschlager et al., 2010).

This paper provides a detailed analysis of the structure and sectoral breakdown of the iron and steel stock through a bottom-up analysis and permits a precise insight to what extent the future raw material supply can be secured through secondary raw materials.

2. MATERIAL AND METHODS

For this paper, a bottom up analysis was chosen to gain information from small entities like products and units, which then were summarized to bigger fractions, like segments and sectors. The bottom up analysis allowed a very detailed and precise capture of steel quantities and was based on: 1. Number of items; 2. Sales figures

The author generally tried to determine the stock of iron and steel based on inventory levels. Only if data were poorly itemised or missing, sold quantities (production plus imports minus exports) - multiplied by their average lifetime - were used to provide estimated totals.

3. RESULTS AND DISCUSSION

The generated results for Austria show that the stock of iron and steel adds up to a total of 43.6 million tonnes or 5.2 tonnes per capita. As figure 1 shows the largest portion of iron and steel with 22.6 million tonnes or 52% belongs to the construction sector, while 7.6 million tonnes (17%) each are bound in the sectors vehicles and metal ware. Machine engineering is the sector with the smallest share of 5.8 million tonnes or 14%. Although all data were gained with the most possible accuracy, all results contain more or less significant uncertainties. The range is estimated between -50% and +100%. The calculated lifespan varies strongly, depending on the product and utilisation and is between < 1 until 100 years.

Analysing the different sectors, the construction sector stands out with the largest share of the total iron and steel stock (22.6 million tonnes or 52%). Within the segment infrastructure, the strong contribution of public utilities and bridges is remarkable (6.3 million tonnes resp. 2.6 million tonnes).

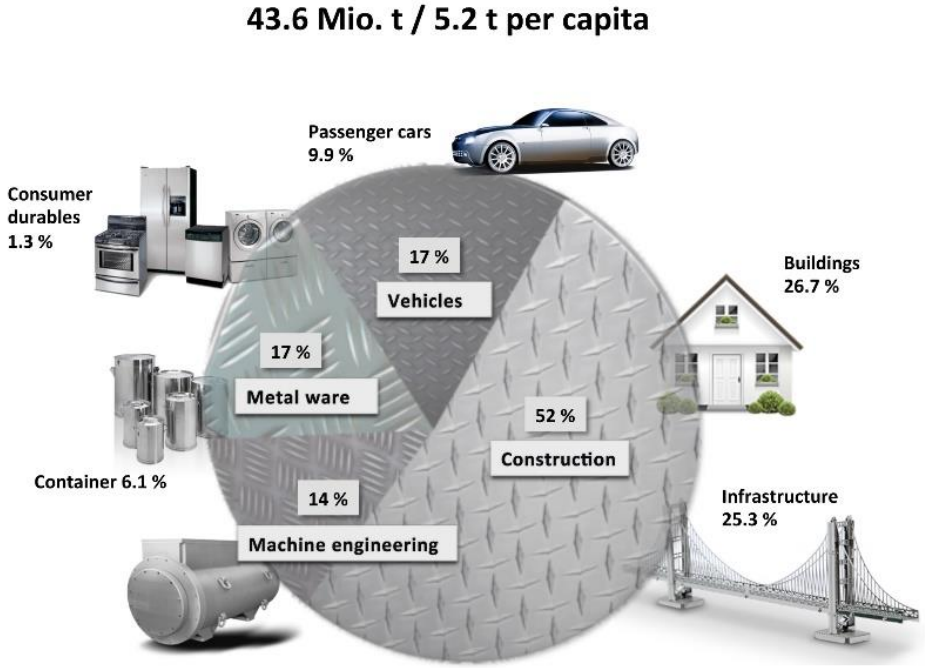

Figure 1. Iron and steel quantities in Austria 2010 divided by sectors

The sector vehicles is the second biggest one with 7.57 million tonnes or 17%, dominated by passenger cars with a share of 4.4 million tonnes of iron and steel (9.9%). From a quantitative point of view, the trucks (1.9 million tonnes) and rolling stock (670,000 tonnes) are noteworthy. In the sector machine engineering 5.8 million tonnes (13.4%) of iron and steel have been accumulated, with great shares of AC/DC motors (1.3 million tonnes), agricultural and forestry machinery (940,000 tonnes, without tractor trucks), generators (650,000 tonnes) and pumps and compressors (630,000 tonnes).
In the sector metal ware (7.6 million tonnes or 17.3%) hardware (2.7 million tonnes) and container (2.7 million tonnes) take the biggest parts. The segment Other metal ware (1.0 million tonnes) contains mostly basic commodities or furnishing.

4. CONCLUSION

The main goal of this paper was to provide a detailed analysis of the structure and sectoral breakdown of the iron and steel stock to secure the future raw material supply through secondary raw materials.
The findings for iron and steel in Austria bounded in objects or items indicate a high potential for the use of steel and iron scrap. The largest amount of iron and steel can be found in construction, which is due to the long lifespan of buildings and infrastructure not available in the short term. The vehicle sector in contrast, dominated by passenger cars with a share of 10% of the total steel and iron stock can be a valuable contribution to the increased use of iron scrap, as well as consumer durables due to their short-term availability. Stock changes were not an issue in this work because no material flow analysis was conducted. But through stock inventory of products and units and their predicted lifespan a theoretical change (renewal rate) in iron and steel stock can be estimated and should be around 1.7 million tonnes per year or 0.2 tonnes per capita and year. This figure assumes a constant iron and steel stock (scrap generation equals input of iron and steel) and disregards its growing over time.

AKNOWLEDGEMENTS (unnumbered list)
Financed by Montanuniversität Leoben, Univ.Prof. Dipl.Ing. Dr. techn. Johannes Schenk

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