Socio-Economic Importance of Manganese

PILLAR I – Preliminary Estimates of Economic Contribution

Manganese (Mn) plays an important role in the global economy, even if the dependence of various industry sectors, products and/or applications on Mn is not always recognised. The mining of Mn ore and production of Mn ferroalloys make significant economic contributions to national economies where these activities take place. By virtue of its desulphurising, deoxidizing and alloying properties, Mn has also become a critical raw material input and process additive for the steel industry. Although around 90% or more of Mn ore is used as direct feedstock for ferroalloys or steel production, the remaining ore is used in the production of specialist metallurgical and chemical products. These find application in a wide range of uses, including agricultural feed and fertiliser, waste water treatment and dry cell batteries.

In 2012, RPA completed the first of three pillars of work aimed at providing an assessment of the socio-economic importance of the production, refining and downstream uses of Mn. The Pillar I analysis provided a top-down analysis of the key value chains for Mn, starting from Mn ore production, through Mn alloy production and focussing on the major downstream user sector, the steel industry. It analysed the economic importance of Mn ore and alloys in terms of their direct economic value to the industry, as well as its indirect value to national economies. It also analysed the direct and indirect effects of Mn ore and alloy production on employment (jobs and wages).

KEY FIGURES FROM PILLAR I

Manganese Ore (2010)
- Global Mn ore market is valued at US $6.4 to US $7.7 billion/year
- Value to national economies is estimated at US $13 billion to US $16 billion/year
- Directly employs 35,000 to 62,000 workers with wages of US $719 - US $1,054 million/year

Manganese Alloys (2010)
- Global Mn alloy market is valued at around US $22.6 billion/year
- Value to national economies is estimated at US $134 billion/year
- Directly employs 45,000 to 60,000 workers with wages of US $463 – US $645 million/year

Pillar I used basic production and economic data, as well as modelling tools, and employed a very conservative and narrow definition of the Mn industry in order to avoid over-estimating the economic contribution from ore and alloy production. There were large uncertainties surrounding some of the resulting estimates due to reliance on a subset of sometimes inconsistent data.

In terms of identifying the contribution that Mn makes through its downstream uses, the analysis examined its criticality as a constituent of steel, with a more detailed consideration of 200-series stainless steel and High Strength Low Alloy (HSLA) steel. Assessment of its value in use in other steel types, was not within the scope of the study.

The Pillar I analysis also considered the potential socio-economic contribution of Mn in lithium manganese spinel (LMO) batteries, which are used for electric vehicles. In this case, the focus was on the role of Mn as an enabling technology and the potential environmental and human health benefits from the reduction in CO₂ and other atmospheric emissions associated with the increasing consumer uptake of electric vehicles.
PILLARS II AND III - Addressing Data Gaps and Regulatory Defence

One of the aims of Pillars II and III is to develop a more robust and illustrative socio-economic analysis (SEA). The work will focus on improving the quality of the data used in estimating the full economic contribution of Mn mining, refining, alloy and slag production, as well as Mn chemical production. This includes collecting more company-specific data on production and value chains, turnover, employment, wages, capital investment, R&D, taxes, and other expenditure. This work may best be carried out at a regional level (e.g. Asia, Europe, Africa).

Additionally, the work will aim to capture the benefits of Mn in specific downstream user sectors or applications that make significant economic contributions to the global economy and which would not exist, in their current state, without Mn. This includes use in high Mn steels (e.g. Hadfield steel or high Mn TWIP steel) and low Mn Steels (e.g. construction steel and low carbon steel). This work will involve an assessment of the criticality of Mn to the properties of the end product and its substitution potential.

Mapping data gaps in the Mn value chain

Pillar II will provide an indication of the importance of Mn production and use to regional economies. Such information is increasingly being developed by other metal sectors to demonstrate their economic importance as part of advocacy and regulatory defence initiatives. Pillar III will also provide the IMnl with information on the potential costs of the introduction of tighter Occupational Exposure Limits (OEL) on Mn and its compounds. This work will include case studies of the costs to selected facilities (ore and alloy producers plus specific downstream users) of meeting OELs at different levels. The findings of this assessment will be particularly useful in discussions with regulators regarding the technical feasibility of meeting different potential OELs and the resulting economic impacts at the regional level.