Future Optimization Solution for Managing Scraps in Medium & Large Scale Manufacturing Industries

Dr. G. Balamurugan
Assistant Professor
Department of Management Studies
Anna University (BIT Campus), Trichy, India

S. M. Prabhakaran
Student
Department of Management Studies
Anna University (BIT Campus), Trichy, India

Abstract

It is unlucky, but many medium and large scale manufacturing industries in South India don't take improvement of the financial prospect that scrap material from their manufacturing process presents. They think of this material as a "crucial sin" of their business without accepting the benefits and protection that a proficient scrap management program can provide. Usually, scraps can create a great deal of further revenue for their industry. In addition, Manufacturers won`t gives attention to scraps because they don`t tolerably track and control the scrap they are selling. This study focuses on to give future optimization solution that helps in managing scraps effectively and with profitability in medium and large scale manufacturing industries.

Keywords: Scrap, optimization, Profitability, Revenue, Manufacturing

I. INTRODUCTION

Iron and steel continue to be the leading metals used by the several medium and large scale manufacturing industries especially in areas such as defense, machinery, consumer-goods industries, industrial equipment manufacturing and automobile industries. Most of the medium and large scale manufacturing industries buy their raw materials from SAIL (Steel Authority Of India Limited). For each and every product to be manufactured, scraps will arise in a large manner.

Most of manufacturers have the same question in mind "Why should we manage scraps". Scrap by meaning "discarded metal for reprocessing" or by definition "waste metal or used articles made of metal, often collected and reprocessed". The scrap managing sector is considerably important to the manufacturing supply chain, contributing 130 million net tons of feed stock yearly for steel mills worldwide. For the scrap industry, one of the key utensils in allowing it to be thriving in recovering the material is the manufacturing shredder, an innovation that the scrap industry says ranks in importance at the side of such other renovating technologies as the printing press, internal combustion engine and the personal computer. Finally, a technology emerged that could help managing scraps keep pace with the pace of giving additional revenue for the manufacturers. Normally in selling scrap, the following two principles rule:

1) Know what you're selling Vs what you're getting paid for.
2) Incorporate sorting and cleaning-up in your production stream to reduce the sorting and cleaning costs your recycler must subtract from your price per pound.

II. CURRENT SCRAP PREPARATION TECHNIQUES:

A. Manual Sorting and Preparation

Large items such as boilers, columns, I-sections, beams, appliances and structural steel must be cut to allow them to be charged into a furnace. This can be done by using shears, hand-held cutting torches, crushers or shredders. Manual sorting obviously involves the removal of components from the scrap by hand. It is most suitable when mixed attachments have to be removed from the scrap or when manual off-loading is inevitable. The separation of metallic from non-metallic is also often accomplished manually.

B. Magnetic Separation

Magnetic separation is used when a huge amount of ferrous scrap must be divided from other materials (Ferrous scrap from boilers). Permanent magnets and electromagnets are used in this process. Magnetic partition can be of either the belt-type or the drum-type. In the drum, a permanent magnet is located inside a rotary shell. Material passes under the drum on a belt. A belt separator is parallel except that the magnet is located between pulleys around which an incessant belt travels. Magnetic separation has some limitations. It cannot separate iron and steel from nickel and magnetic stainless steels. Also, combined parts containing iron will be collected and could contaminate the melt. Hand sorting may be used in combination with magnetic separation to avoid these occasions.

C. *Eddy Current Separations*

Eddy current separators are used to split non-ferrous metals from waste and automotive shredder residue. This process generally follows the crucial magnetic separation process, and it utilizes the electrical conductivity of non-magnetic metals. This is attained by fleeting a magnetic current through the feed stream and using repulsive forces interrelate between the magnetic field and the eddy currents in the metals.

The simplest function of this process is the inclined ramp separator. This uses a series of magnets on a sloped plate covered with a non-magnetic sliding surface such as stainless steel. When a supply of mixed materials is fed down the slope (ramp), non-metallic materials slide straight down, while metals are repelled sideways by the interface of the magnetic field with the induced eddy current. The two streams are then collected separately. Deviations of the eddy current separator consist of the rotating disc separator, in which magnets are prearranged around a rotating axis. Yet another system uses a conveyor with a head pulley fitted with magnets. Both systems rely on the varying trajectories of materials either affected or unaffected by magnetic fields, to make the separation.

D. *Scrap Size Reduction Processes*

A wide range of equipment is used to reduce the amount of bulky scrap material into pieces small adequate to enable combination, delivery and subsequent feeding into furnaces. The equipment used to carry out this includes shears, flatteners, and torch-cutting and turning grinder. This equipment is usually controlled by dealers and processors who prepare the scrap to feed into the steel mills.

1) *Baling Press:*

Movable scrap that has a lofty surface area and low density (i.e. lathe turnings) must be crushed by baling or briquetting. A baling press is a heavy piece of handing out equipment that uses up to three hydraulic rams to squeeze the scrap that requires larger density before re-melting. With 600 horsepower, the biggest baling press can take three flattened autos without engines and in less than two minutes. At 100% effectiveness, this machine will process just over 40 lbs of scrap per hour.

2) *Briquetter:*

In a Briquetter, tiny scrap is crushed into pockets as it surpasses between two counter rotating drums; compaction can be supported with heat depending on the material.

3) *Shear:*

The hydraulic guillotine shear slices heavy pieces of steel including I-beams, columns and railroad car sides. Shears vary in size from 300 tons to more than 2000 tons of head force.

E. *Shredding*

Shredders or fragmentizes can reduce old automobile wrecks into fist-sized pieces using massive hammer-mills. A medium-size shredder uses 36 hammers weighing 250 lbs each to pound auto hulks to pieces. Although the leading raw material for the shredder is automobile hulks, "white goods" (household appliances such as stoves, washers, dryers, and refrigerators) and other large items can also be shredded. Depending on its size, a shredder can process from 1500 to more than 20 000 tons of scrap per month.

This process produces three types of material: ferrous metal (iron and steel), shredder residue (light fraction) and shredder residue (heavy fraction). The two residue fractions, either singularly or collectively, are frequently referred to as automotive shredder residue (ASR). "Shredder fluff" is the term given to the low density or light materials, which are collected during the shredding process for cyclone air separation.

III. FUTURE SOLUTION OF SCRAP OPTIMIZATION

There are four integrated operating modules for cost-effective management of the entire scrap supply chain with full isolation and traceability.

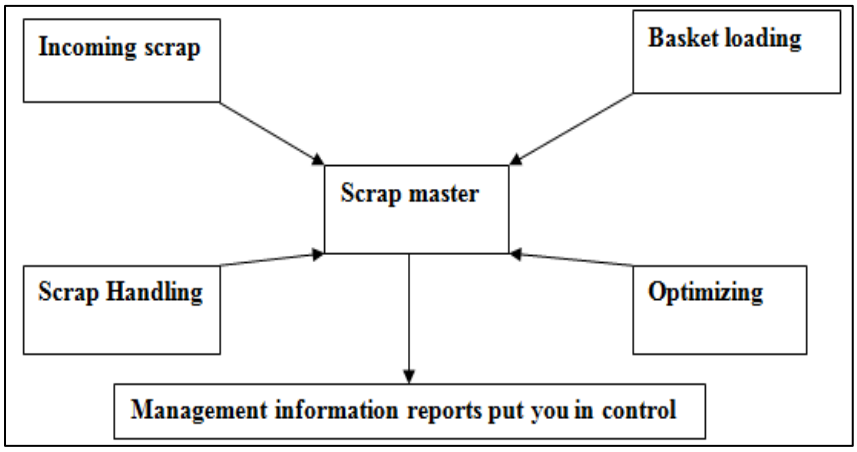

Fig. 1: Future Solution of Scrap Optimization

A. Scrap Master

ScrapMaster can unlock considerable investments such as:

- Save on external scrap acquiring
- Understand the highest value of internal scrap
- Charge the finest scrap mix on time, every time
- Examine the entire scrap charge history

B. Scrap Optimization

ScrapMaster now joined together to form a software suite in order to manage scraps. It is called BOSS (Blending Optimization Software Suite) functionality under the license of Management science associates Inc. BOSS is one of the world's foremost optimization program. It calculates the cost based on yield wise:

- Actual scrap cost per ton of steel
- Value of the scrap inventory on a real-time basis
- Minimizes scrap charge cost, grade by grade

It is based on specific grade fabrication data entered by the steelmaker such as intended tonnage, scrap composition, prices, ease of use and inventory.

C. BOSS Functions

- Single heat optimization
- Multi heat optimization
- Campaign optimization
- Scrap buy planning
- Inventory management
- Results feedback and interpretation

D. Optimization Process Flow

There are three stages in this software process. They are as follows:

- Stage 1: Input the data about scrap
- Stage 2: Input the data about steel
- Stage 3: Optimized design

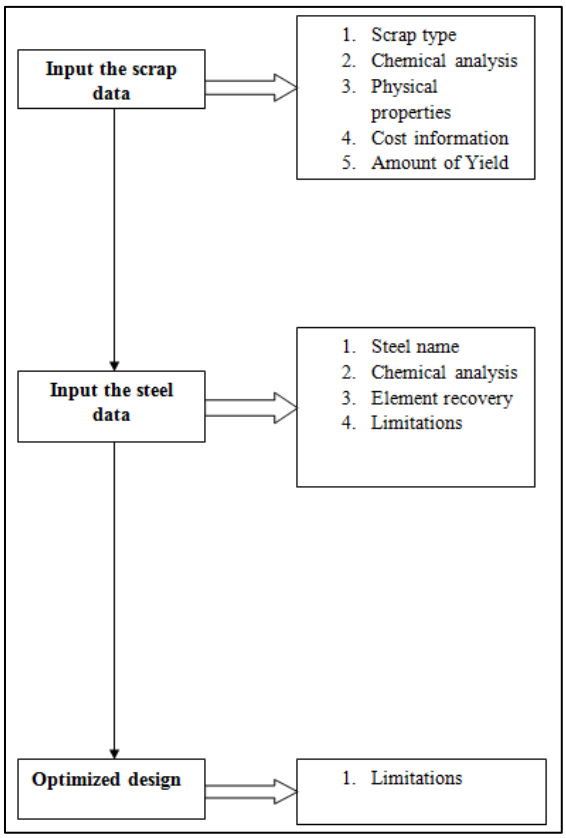

Fig. 2: Optimization Process Flow

E. Improvement of Optimization

There are 8 stages in order to improve:

- Stage 1: Receiving scrap
- Stage 2: Chemical data should be analyzed
- Stage 3: Analysis of scrap should be updated
- Stage 4: Melting EAF
- Stage 5: Results
- Stage 6: Analyzed scraps Vs steel
- Stage 7: Confirm results
- Stage 8: Feedback data

Continuous feedback helps the improvement of process.

F. Factors for Optimization accuracy

- The weight of scrap will be recorded accurately
- Knowing of the exact charge of scrap
- Clear understanding about the impact of optimization
- Model will be updated as more and more information is gathered

IV. CONCLUSION

Scraps play a major part of many manufacturing companies in order to increase the revenue. The Objective of this study explains the current preparation and sorting techniques of scraps. In addition, this study focuses on the future solution for optimizing the scraps in an effective and profitable manner. Also, it explains the process of Blending optimization software suite, how it works and industries will come to know how to improve it.

REFERENCES

[1] Institute of Scrap Recycling Industries (ISRI) website www.isri.org
[2] Institute of Scrap Iron and Steel, Handbook, Oct. 1979, p. 110.
[3] C. Marique (Ed.): Recycling of Scrap for High Quality Products, 1996 Report of the ECSC Research Project 7210-CB, Brussels, 1997
[4] 1 R. J. Fruehan (Ed.): The Making, Shaping and Treatment of Steel - Steelmaking and Refining Volume (11th edition), AISE Foundation, 1998
[5] Optimization solution for scraps – Harsco metals corporation
[6] International Iron and Steel Institute (IISI) website www.worldsteel.org.
[7] W. Reichelt: Contiarc - A new scrap melting technology, Iron and Steel Engineer, July 1998
[8] W.J. Stevenson, Operations Management, 10th ed., New York: The McGraw-Hill
[9] Companies, 2009.
[10] D.C. Montgomery, Introduction to Statistical Quality Control, 2nd ed., New York: John Wiley, 2000.
[11] S.M .Dudhal1, B. S. Jonwal2, Prof. H. P. Chaudhari3, "Waste Segregation Using Programmable Logic Controller", International Journal For Technological Research In Engineering Volume 1, Issue 8, April-2014 ISSN.