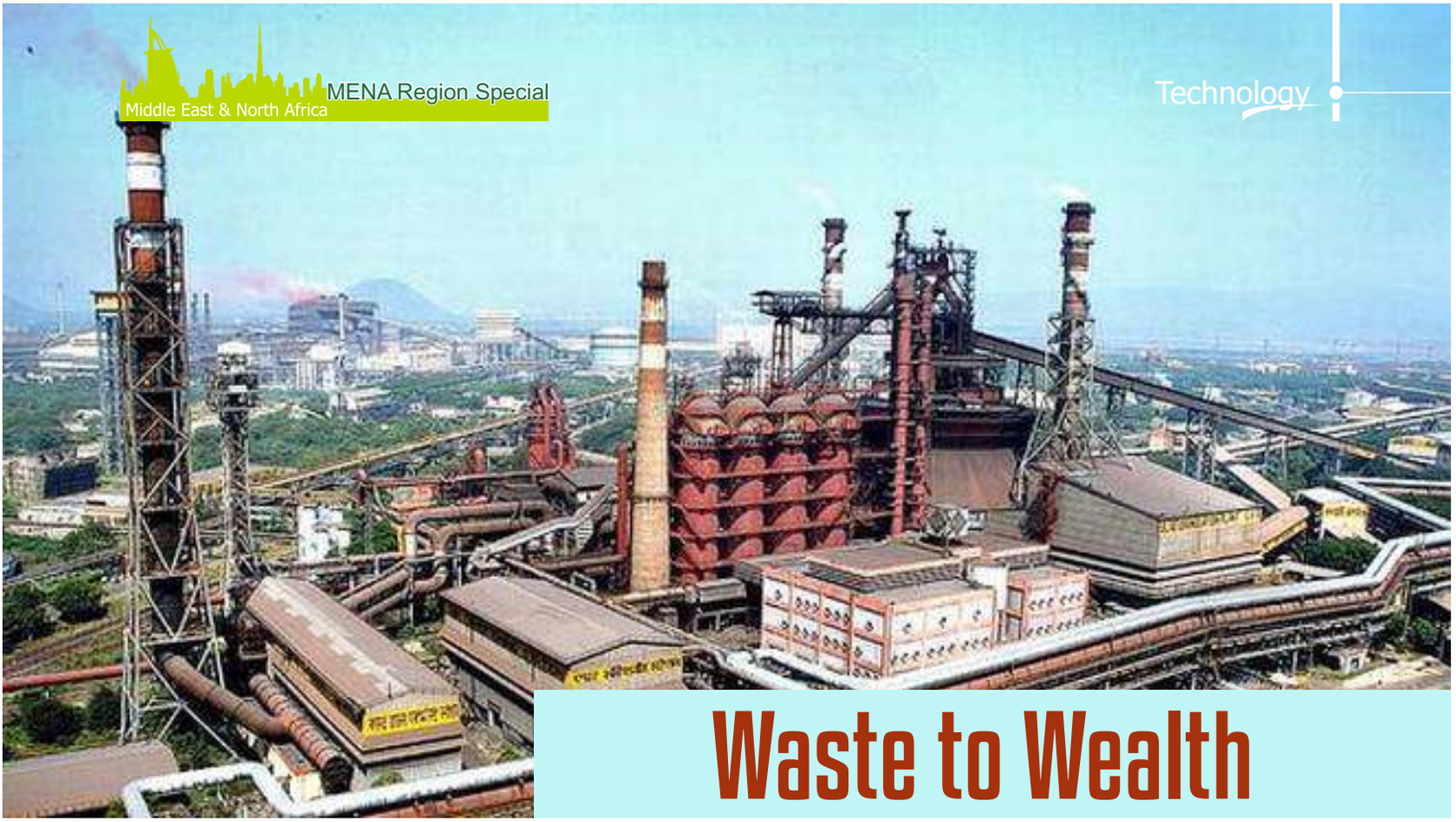

Waste to Wealth

- Pawan Verma
CEO,
Techno Enviro Sevices Pvt Ltd.

The recycle, reuse and recovery of waste generated in a BF- BOF route Integrated Steel Plant, historically has been accorded a low priority which is evident by huge mountains of solid waste around these plants.

In the past, major reasons were low per capita steel consumption, availability of abundant cheap raw materials and lack of awareness and recycling technologies. Surprisingly, even now, most of these plants are wasting valuable resources and dumping them in ash ponds.

In recent years, unsustainable mining practices have led to exploitation of natural resources causing extensive environmental degradation. Moreover, continually increasing demand for metals, declining ore grades and complex new deposits are all contributing to a rise in greenhouse gas (GHG) emissions from primary metal production. The consequence of this is fact that the mineral processing and metal production sector is coming under increasing pressure to improve the overall sustainability of its operations, especially by decreasing energy consumption, GHG emissions and waste disposal.

Industrial sustainability is the ultimate goal of modern society, particularly so for the iron and steel making industries. gases of the steel plant.

Kyoto Summit has laid serious concern for environmental issues and GOI under National Steel Policy 2011 and The Ministry of Environment & Forest (MOEF) has launched the Charter on "Corporate Responsibility for Environmental Protection (CREP)" in March 2003 which in nutshell directs all steel companies that “Industry shall not store/dump solid wastes outside the factory premises in any circumstances without prior permission of the Board. Industry shall submit a time bound action plan to reduce solid waste by its proper utilization and disposal.”

Probably the most fundamental changes are those of public attitude, awareness and acceptability with respect to waste. These changes are increasingly applying pressure to minimize waste, encourage waste recycling and demanding waste disposal as landfill to be the last option.

Utilizing solid waste is an option today, but it's likely to be a necessity very soon.

21st report of Standing Committee on Coal and Steel (2015-2016) has recorded that about 43% steel is produced through the conventional integrated route of BF-BOF. The Committee noted that during the year 2014-15, the country produced 88.25 MT of crude steel; thus, around 38 MT of steel is produced in BF-BOF route. Taking solid waste generation in BF-BOF in around of 450 kg/t of crude steel, the industry has produced 19 MT of solid waste, of which only 12 to 18% is recycled. This is an alarming scenario.

Depending on the type of waste, it can be returned to the process a senergy source or raw material for steel fabrication or else be traded asco-product to other industrial applications. The reuse of these productsis of great importance for the sector regarding both economical and environmental aspects.

A limitation of dust to be fullyre-used is its variable composition and the high cost of implementing newtechnologies of recycling. But with the changed statutory obligations, public protest/ban against landfill and high cost of disposal has made it possible to economically recycle many

wastes. The cost of storing 1 Mg of dust may accountfor 50% of the price of 1 Mg of steel. These dusts cannot be storedanymore in open landfills.

Recycle of High Iron Bof Sludge

There are high iron oxide bearing wastes which always has very lucrative return on investment, and proven technology is also available, but it is never put in practice in India for the facts better known to our past policy makers. For example, briquetting the BOF sludge and use as coolant. During 2014-15, approximately 38 MT crude steel was produced in BOF, approximately 0.57MTof GCP Sludge was generated which could have replaced almost equal or more quantity of coolants required in BOF.

This loss has amounted to very considerable proportions in the past.

There are numerous methodologies and processes developed to recycle the steel plant waste, like collecting all fine dusts, sludge and mill- scale and agglomerate into micro pellets to use in the Sintering Plant or Blast Furnace as substitute to iron ore.

The ideal metallurgical briquette for use in the iron and steel refining processes should possess the property of resisting spalling, shattering, and decomposition and thermal disintegration at high temperatures, otherwise the disintegration of the briquettes charged to a convertor, for example, merely results in the blowing of the fine particles out through the top with an incident increase in the fine dust and sludge- waste. A satisfactory and successful briquette for commercial use should possess sufficient compression and impact strength so that it can withstand the rigorous handling to which it is subjected in conveyors, loading and charging devices. Such strength should be imparted to the briquette not only immediately upon its fabrication, but during its subsequent period of handling and storage prior to use. A satisfactory briquette 'must also be resistant to leaching action, that its binder must be capable of withstanding the washing out action of water.

A briquette made from mix of SMS or BOF sludge, Calcium Hydroxide and Mill Scale with a binder of water soluble molasses and silicate of soda is capable of withstanding thermal disintegration but it requires a drying period before it can be handled or stacked. The control of the moisture content of the briquette is of special importance. Not only the iron oxide waste material contains appreciable amount of moisture, but also the addition of more water to the briquette through the medium of the binding agent increases the 'ultimate moisture 'content of the finished "product which is to be charged or fed to the BOF. If such moisture content is too high, difficulty will be encountered in molding the briquettes, and also in the use of the briquettes due to the generation-of an excessive amount of steam. It is found that if a mix of High Iron Oxide Sludge (total Fe +60% or more and dried to less than 8% moisture), mill-scale, quick lime fines and suitable binders is briquetted, cured over 1100C over a desired period has given a very good results to substitute it as coolant for the BOF.

Mill Scale Briquette ("SM Briquette")

However, we should not use high iron containing oxides for Micro Pelletisation and use as substitute for low value iron ore when that rich iron oxide can be recycled as high value coolant for BOF.

For use in sintering, the beneficiated BF dust and sludge can result in recovering high grade fines with reasonable yield by floatation and low intensity magnetic separation techniques.

Sludge + Mill Scale Briquette ("SM Briquette") cannot replace steel scrap 100% in Convertors. Usage limits are not very clear due to slopping problems. One expert says that normally SM Briquette can replace steel scrap up to 30% ~ 50% but will depend on many factors including Slag Characteristic (SiO2), Convertor Dimension, Operation Technology and Blowing Pattern (Hard or Soft) etc. In my judgment, without much difficulty, cold SM Briquette of 200,000 tons per year can be consumed for 6 million ton steel plant.

The process of briquetting technology is a simple; environmentally friendly method of agglomeration, some difficulty is there in de watering of sludge to less than 8% and selecting the appropriate binding media.

- An economic solution enabling to avoid the loss of product under dust shape, uniformity of product obtained, reduction of dust volume, recycling of a product at high value added.
- An ecologic solution, accepted on the environment level, consisting of the problem solution associated to the production and dispersion of dust and therefore to the atmosphere and ground pollution.
- There are many examples World over where the BOF Sludge has been briquetted and charged successfully as coolant.
- POSCO has been using Sludge + Mill Scale Briquette ("SM Briquette") as substitute to steel scrape for long.
- The reduced oxygen consumption is another benefit; as the presence of oxides is high in the GCP sludge.
- Further, the converter sludge briquettes, having high percentage of lime, would also reduce lime consumption.
- The bio mass binder, molasses, may add heat value.

In India good efforts has been put in by JSW and Bhushan Steel for Sludge + Mill Scale Briquette ("SM Briquette") to recycle and value addition by using in convertors.

There is successful, proven and tested technology available to deliver a Sludge + Mill Scale Briquette Plant to replace coolant materials.

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