

Why the future of steel is circular

A circular economy approach to manufacturing is gaining currency globally because of its advantages for the environment, but few Indian companies are embracing it

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What has climate change got to do with circular economy (CE) that steelmakers and also producers of non-ferrous metals such as aluminium and copper in some countries are practising with slow but steady progress so far? A lot. Steel alone is responsible for a quarter of global greenhouse gas emissions of all industries.

This is in spite of the steel sector achieving significant improvements in efficiency in use of raw materials and energy and scrap recycling over the years. A part of CE, steel scrap recycling through electric arc furnaces (EAF) constituted 28 per cent of the global steel production of 1.69 billion tonnes (bt) in 2017.

The EAF route of making steel requires 56 per cent less energy than when the metal is produced from iron ore. As for aluminium, scrap recycling will require just about 5 per cent of the energy used in smelting primary metal from alumina, which in turn is refined from bauxite. CE is fundamentally a prescription for creation of a highly resource efficient economy where carbon footprint will get automatically reduced. As for metals, CE prescription is that when products reach their end of life, they should be productively used again by way of recirculation and recycling. CE goes beyond end-of-life metal products recycling to the use of by-products such as steel slag for cement making and laying of roads and pavements.

Aluminium presents an interesting case where carbon emissions have a direct link with

CARBON EMISSIONS

• 1 tonne

CO₂ per tonne of metal when aluminium is derived by way of scrap recycling

• 3 tonne

per tonne of primary aluminium when modern smelters use hydro power

• 20 tonne

per tonne of aluminium when smelters use coal-fired electricity

▪ The EAF route of making steel requires 56 per cent less energy than when the metal is produced from iron ore

▪ Scrap recycling will require just 5 per cent of the energy used in smelting primary metal from alumina

how the silvery white metal is produced. Carbon emissions are at the lowest at 1 tonne CO₂ per tonne of metal when aluminium is derived by way of scrap recycling. These go up to 3 tonne per tonne of primary aluminium when modern smelters use hydro power. But smelters using coal-fired electricity are responsible for emitting CO₂ of up to 20 tonne per tonne of aluminium. India's entire 4.1 million tonne (mt) aluminium smelting capacity is thermal power based. Therefore, the smelters here leave a bigger carbon footprint than the ones using electricity derived from hydro and natural gas resources. Smelters in China, which last year alone had a share of 32.27 mt in the world aluminium production of 63.2 mt, draw 90 per cent electricity from thermal stations and 10 per cent from hydro units.

Surprisingly, China, the world's largest source of planet warming carbon emissions, was among the first countries to be off the block

to introduce CE policy regulations in 2008. The European Union followed suit in 2013. CE practices are steadily gaining ground in the US and several other countries trying to clean up the environment. But India is still to be awakened to the benefits inherent in the concept. It is, therefore, encouraging that Tata Steel managing director TV Narendran has dropped hints that as his company will remain in pursuit of capacity build-up through brownfield route and acquisition of distressed assets, it will be progressively embracing circular economy practices.

Tata Steel mills at Jamshedpur and Odisha's Kalinganagar and the recently acquired Bhusan Steel have between them a large profile in flat products. Because of high value addition in such constructions, the cost of their transfer from production centres in the east to consumption points in the west, north and south is not a concern for the company. But this is not the case for more commonly used long steel

used in house building and other constructions where any numbers of producers close to all consumption points are present.

Here precisely CE will come into play for Tata Steel as it goes on a drive to set up scrap collection centres in different parts of the country like the one it has created close to Delhi. The idea is to make "green steel" from scrap using EAFs to service clients within a 300 km radius. The strategy will help Narendran in two ways: First, he will have thereby more long steels in his portfolio. Second, recycling of scrap is a natural resource conservation exercise where the CO₂ emission is much less than making steel through conventional blast furnace route.

To come to the basics, CE is a concept that promotes an industrial system regenerative in nature. An Ellen MacArthur Foundation study says: "In a circular economy, products are designed for ease of reuse, disassembly and refurbishment, or recycling. CE will prompt decoupling of economic growth and materials inputs." Even while CE is in practice in select countries for around a decade, discussions on the subject are still focussed on recycling of metal products and finding use for by-products. Accelerating the transition from a linear to CE will demand of industry giving sufficient attention to circular design (CD) that will allow remanufacture and reuse of steel products in application in construction, machinery, automobiles and ships.

The world wants to move to a more resource efficient and an increasingly less CO₂ emitting economy. CD that will allow remanufacturing of products with necessary corrections in pursuit of the twin goals have been taken up seriously by some companies in Europe and the US. Incidentally Wabco of the US, a world leader in heavy vehicles control system and playing a pioneering role in CD, has a major presence in India in partnership with TVS Group. Not to speak of emerging nations, in developed economies too the share of remanufactured products in total manufacturing output remains miniscule.

CE practices will flourish in a regulatory environment that ensures the viability of circular businesses. Benefits by way of optimal resource use, energy savings and low carbon emissions are inherent in a CE. But industry will need a supportive environment to make investments in creating CD facilities, setting up remanufacturing units and market promotion of remanufactured goods for any country to reap sustainable CE benefits.

In our country, CE awareness is still low. What, however, is encouraging is that steel secretary Binoy Kumar and some industry officials, including Narendran are becoming vocal about CE, whose relevance to the Indian economy will gain traction over time. Metals industry will be spared the criticism of aggravating landfills menace consisting of toxins, greenhouse gases and leachate if it starts paying attention to reuse and recycling. Hindalco subsidiary Novelis, the world leader in automotive sheets and cans, is using scrap and primary aluminium in the ratio of 60:40. Hopefully, Hindalco will on the lines of Novelis take up aluminium scrap recycling on a growing scale.