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Sustainable Development of Steel Industry in India

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Abstract

The world steel industry applies the principles of reduction, reuse and recycling in many ways, in order to improve the sustainability of the industry. Steel is the most recycled product and its recycling accounts for significant raw material and energy savings. From an environmental point of view, steel recycling has an enormous impact on the reduction of Co_2 emissions as well as in minimizing environmental footprint. The Indian steel industry currently is at a crucial stage with challenges of climate change. While the industry is expected to accelerate steel production to meet the demand by infusing additional capacity, global issues like climate change necessitates guided growth for steel production through low carbon-intensive routes. Thus, the steel makers across the country need to adopt energy-efficient and eco-friendly technologies in all areas of iron and steel making to make it more sustainable. The present paper is an attempt to study the recent changes in the Indian steel industry in the competitive global market and the efforts being made to move towards sustainability. The study is based on secondary data derived mainly from the Ministry of Steel as well as annual company reports.

Introduction

The world is blessed with a vast and varied wealth of natural resources. With these comes the responsibility to ensure their preservation and to make our dear Earth a healthier planet. In the new knowledge-based and technology-driven global economy this can be achieved only by integrating our economic, environmental and social goals and policies with various levels of government, both within the country and at global levels. The new paradigm of development is not the game of economics alone as issues related to the economic, ecological, political, technological, cultural and legal aspects are more important. All of these have to be merged into a collective form, marking its way for sustainable development. Sustainability, or sustainable development, is aimed at improving the quality of life for everyone, now and for generations to come. It encompasses environmental, economic and social dimensions, as well as the concept of stewardship, the responsible management of resource use. Contrary to the common belief, sustainability in the industrial or corporate sector does not mean only corporate social responsibility but much more than that.

Steel is essential to the modern world and

Is critical in enabling man to move towards a more sustainable future. Steel is fundamental in a greener world, whether in lighter or in more efficient vehicles, in renewable energy generation, in new highly efficient power stations and construction of smart electrical grids or in transport infrastructure development and high energy efficient residential housing and commercial buildings.

Over 1.3 billion tons of steel are produced and consumed every year and this will continue particularly in developing economies where steel helps to raise social and material welfare and also create infrastructure. However, sustainability calls for judicious use of scarce raw material. To achieve such a purpose this industry has welcomed techniques involving the reuse of steel. The world steel industry applies the principles of reduction, reuse and recycling in many ways, in order to improve the sustainability of the industry.

Steel Scenario – Global and Indian

Steel is the most sought after material especially in this ever expanding industrial and urban world. It can apparently be stated that iron and steel has little or no competition because of its ideal combination of strength, rigidity and workability and the relatively high cost of alternative materials. Moreover, the steel industry has very strong forward and backward linkages in terms of material flow, income generation and employment creation; hence the economic prosperity and growth of this economy is very closely related to the quantity of steel consumed by it. Yet the performance of this industry has been cyclical and changes in GDP have a disproportionately high impact on demand (fig. 1).

The oil crisis of the mid seventies and early eighties, the collapse of U.S.S.R and Eastern Bloc, the Asian crisis of the late nineties, the 9/11 episode and its aftermath and the most recent economic crisis have all contributed to plummeting of demand for finished steel. In case of India too ,several factors were responsible for fluctuating demand for steel. Wars with China in 1962 and with Pakistan in 1965 and 1971; a flood of refugees from East Pakistan in 1971; droughts in 1965, 1966, 1971, and 1972; currency devaluation in 1966; and the first world oil crisis, in 1973-74, all jolted the economy. However, this phase was reversed from 1991-92, when the country replaced the control regime by liberalization and deregulation in the context of the New Economic Policy.

Slight recovery in the major advanced economics, coupled with the solid growth in the most emerging and developing economics presents a positive outlook for the global economy on the whole. WSA forecast suggests that in 2013, the emerging and developing economics will account for 73% of World steel demand. The Global steel demand during 2012 is expected to grow by 3.6% to 1422 Million Tonnes, moderating slightly as compared to a 5.6% growth in 2011. It is expected to grow further by 4.5% to around 1486 million tones in 2013, as per WSA forecasts (fig 2). Steel industry experienced tremendous growth over the last decade largely due to Chinese growth. China produced 696 million tonnes in 2011 thereby becoming the key driver in steel market. China's crude steel capacity is expected to be around 840 million tonnes in 2012 which would be 22% in excess of the expected 688million tonnes of consumption. China's growth in steel demand in 2012 and 2013 is expected to moderate to 4.0% following 6.2% growth in 2011. The continuing slowdown of Chinese steel demand is mainly driven by the Chinese Government's efforts to restructure the economy.

As per the WSA, India maintained its ranking as the 4th largest steel producer in the world with a production of 71.3 million tones in 2011, registering a growth rate of 4.4% over 2010 (Table - 2, fig. 3). According to JPC estimates, domestic finished steel consumption posted a growth of 6.8% during 2011-12 to 70.92 million tons. The World Steel Association has projected a growth of 6.9% for steel consumption for India during 2012, which is higher than the growth in steel consumption projected for China (4%). In 2013, the growth rate is forecasted to accelerate to 9.4% on the foundation of urbanisation and surging infrastructure investment (fig. 4). A growth rate of 8-9% in the next few years is expected to be sustained mainly by factors such as the 1 trillion USD investment envisaged for the infrastructure sector in the 12th Five Year Plan, greater emphasis on increasing growth rate of the manufacturing sector, higher rates of urbanization, rising middle class population and tapping the potential of the

rural market. In terms of per capita consumption of finished steel also, India is only 57 kg lags behind the world average of about 215 kg, indicating a huge potential for growth.

The price of raw material is likely to affect the cost of production in the Indian steel industry. There has been a price increment in the last decade wherein price of iron ore increased by 6.6 times, coking coal 4.7 times and scrap 3.7 times (fig. 4). Despite crisis, expansion plans keep growing. In 2011, steel making capacity increased by 80 million tons resulting in an estimated 493 million tons of excess capacity including150 million tons in China. The global capacity in 2011 was 1979 million tons crossing over to 2000 million tons in 2012 expecting to reach a target of 2127 million tons in 2014. World steel use which grew at 15.1% in 2010 is likely to slow down to 3.6% in 2012. India is expected to show relatively higher growth in steel use in the coming years due to its growing domestic economy, infrastructural needs and expansion of industrial production.

In terms of imports and exports, India has become a net importer of steel since 2007-08, with the net imports at 3 million tones during 2011-12. An important reason for the high level of imports has been the domestic non-availability or limited availability of sophisticated/specialized steel products. The GDP growth of the Indian economy was estimated at 6.5% for the Fiscal 2011-12. Reduction in gross fixed capital formation and slow down in industrial production have been the cause of concern. No change in the growth rate is expected in the coming fiscal year, with RBI projecting a growth of 6.5% for 2012-13.

The Union Budget has announced a number of measures to boost the investment climate, with special focus on infrastructure and manufacturing sectors. For the Steel Industry, the key measures are in the form of increasing custom duty on flat carbon steel products from the level of 5% to 7.5%. This along with certain measures to bring back industrial growth should allow for accommodation of additional supply on capacities likely to be commissioned in 2012-13.

The announcements are with regard to reduction in customs duty on machinery imports for mining and mineral sector, especially for iron ore beneficiation and palletisation, which will lead to reduction of overall capital cost. Opportunities seen in the Indian steel market have brought in significant investments in both greenfield and brownfield steel projects.

Crude steel making capacity is set to grow from 78 million tons in March 2011 to 89 million tons in 2012, 119 million tons in 2014 and 149 million tons in 2017, on a rather optimistic scenario. Bulk of the immediate capacity expansions are on the brown field sites and in final stages of completion. Greenfield projects have been delayed due to stricter environmental regulations and delays in land acquisition. There has been a slowdown in completion of the brownfield expansion projects in spite of it being firmly footed.

Major Challenges before the Steel Industry

1. ***Over-capacity*** is likely to continue as an issue with increased capacity in the rapidly growing economies. With government rationalization unlikely to occur in the short term, successful steelmakers will need to optimise their approach to changing market conditions. More thrust is required on improved technologies, lower cost structures, more vertical integration and greater partnering with key customers.
2. ***European sovereign debt crisis*** has reduced confidence in the marketplace in the latter half of 2011 on global economic growth, putting a halt on investments into large-scale infrastructure projects in Europe, and reducing availability of capital for growth. The complexity of the issue is large as growth in steelmaking capacity is expected to continue at pace.
3. A cause of ***volatility is the cost of raw materials***. The shortage of these supplies in the market has allowed suppliers of iron ore and metallurgical coal to rebuild the pricing mechanisms through the shift from annual to shorter-term price contracts. This has created numerous challenges for steelmakers as they must now deal with volatility in raw material prices, as well as maintain margins with fluctuating demand and cannot always pass on the rise in iron ore prices to end consumers demand due to the fragmented market

Indicators of Sustainability in Steel Industry

Economic growth should be inclusive growth and imbibe the principles of sustainability. Jamshedji Tata, the founder of Tata Steel defined sustainability in the following words: *In a free enterprise, the economy is not just another stakeholder, but is in fact the very purpose of our existence. The combination of the three elements of society — social, environmental and economic, ensures sustainability of business for all stakeholders*. Sustainability in the steel industry encompasses reduction in the use of resources on one hand and of carbon dioxide emission on the other. The continued growth in demand for steel makes it necessary to continue converting virgin iron ore into steel. The greenhouse gas of most relevance to the world steel industry is carbon dioxide. On an average 1-9 tons of carbon dioxide are emitted for every ton of steel produced. According to the International Energy Agency, the iron and steel industry accounts for approximately 4-5% of total world carbon dioxide emissions. Taking into consideration the global steel production of more than 1.3billion tons, the steel industry produces more than 2 billion tons of carbon dioxide. Over 90 % of emissions from the steel industry come from iron production in nine countries or regions: Brazil, China, EU-27, India, Japan, Korea, Russia, Ukraine, and the USA (IISI, 2007)

Reducing greenhouse gas emissions is a global problem that requires a global solution. The steel industry believes it is very important that all steel companies and all major steelmaking countries are actively engaged in the search for a future low carbon society. An active and ongoing dialogue is required between governments and industry. Steel is one of the most CO_2 intensive, highly competitive industries, with over 40% of steel traded internationally. Policies must create a level playing field to ensure that steel companies in one region are not put at a competitive disadvantage. In the last 30 years, steel industry in general has reduced its energy consumption per tonne of steel produced by 50%. The production of steel results in the generation of by products that can reduce carbon dioxide emissions by substituting natural resources in other industries. For example blast furnace slag is used by the cement industry allowing it to reduce carbon dioxide emissions significantly. Steel making slags are used as civil works aggregates, thereby saving natural resources and environmental impact.

A change in steel making technology can also contribute towards lowering CO_2 emission. Most of the CO2 generated by today's steel industry comes from the chemical interaction between carbon and iron ore in blast furnace. This process, known as iron reduction, produces molten iron which is converted to steel. The maturity and efficiency of the conventional technology imply that with the most advanced facilities, the iron-reduction process operates close to the thermodynamic limits. Therefore, substantial further reductions in CO_2 emissions will not be feasible with only conventional technologies. However this can be possible with the use of electric arc furnaces as well as by direct ore reduction using hydrogen. Unfortunately the use of hydrogen for iron ore reduction is limited in use and extent and has not found much acceptance in India. An increase in steel production by means of an electric process requires cheaper electric energy, which, in the future, might be achievable either from alternative energy sources or from nuclear energy. In this way, the current share of 32 % of the steel production by an electric process could become higher without involving CO_2 emissions. So far this has not been possible because the quantity of the presently available scrap steel is not sufficient to meet the demand for steel on the market.

Reduce, reuse and recycle are the three Rs of sustainability in the steel industry. Of the three Rs, recycling is probably the most recognized attribute of steel. Steel is the world's most recycled material. Steel scrap is re-melted and used to make new steel. In 2008, more than 475 million tons of steel scrap was moved from the waste stream into the recycling stream (WSA, 2009). This is more than the combined reported totals for other recyclable materials, including paper, plastic, glass, copper, lead, and aluminum (WBCSD, 2009). Steel recycling began in the major cities of the 19th century such as London, Hong Kong and New York, where peddlers collected pots, pans and other metal products that contained valuable steel and sold them on for use in steel plants. This has evolved

into the recycling infrastructure that services the world today. In many applications, steel has a very long life and as a result the contribution of modern steel is improving the efficiency of buildings, plants, machinery and transportation. These are much more important in helping man reduce its carbon footprint than the emissions associated with initial steel production.

In order to continue these efforts and to identify all the opportunities to reduce the carbon emissions from steel's life cycle, it is essential to take a full life cycle approach (fig. 5). This approach not only considers the emissions associated with the manufacture of steel products, but also the reduction in energy consumption associated with the use of new generation-steels in lighter and stronger products. Further, the inherent recyclability of steel must be given prominent consideration in the search for sustainable materials for the future. The World Steel Association has estimated the recycling rates for products that contain a significant portion of steel, and identified target rates for 2050 to be around 90% from 83% in 2007.

Steel recycling accounts for significant raw materials and energy savings. One ton of steel scrap used for making steel saved 1400kg of iron ore, 400 kg of coal and 55kg of limestone. From an environmental point of view, steel recycling has an enormous impact on the reduction of CO_2 emissions. If 450 million tonnes of hot rolled steel were produced from 100% scrap rather then new materials, the total CO_2 savings would be approximately 634 million tons in one year. Steel industry continues to produce thinner quality of steel with greater efficiency and this reduced material need, reduces emission from steel industry. Within a period of 30 years i.e 1975-2005 average energy consumption per ton of crude steel has reduced by 50%. Steel reuse can be described as any process where steel is not re-melted but rather enters a new product use phase.

Another approach to sustainability could be the method of switching over from primary to secondary steel production. In the United States primary steel production using inefficient open hearth furnaces dropped from 44 million tons in 1970 to 6 million tons in 1982 to become completely extinguished by 1992. Primary steel production using the blast furnace (BF) and the basic oxygen furnace (BOF) fluctuated between 40 — 75 million tons over the same period. Secondly, steel production from scrap steel, pig iron or direct reduced iron using the electric arc furnace more than doubled growing from 18 — 38 million tons between 1970 and 1995 (LBNL,1999). Between 1958 and 1994, the share of coal and coke as energy sources dropped from about 75 — 57% of total fuels, to be followed by a drop in the share of oil from 10 — 3%. The share of natural gas used in the industry increased from 10 — 28%. The share of electricity rose from 4 — 11% during the same period, mostly as a result of increased secondary steel production. Carbon emissions too fell from 64 million tons in 1958 to 45 million tons in 1994. Between 1958 and 1994 there was a drop of 27% in the energy consumption per ton of steel but the most important change concerned the growing use of scrap based electric arc furnace for secondary steel production which rose from 17 — 39% of total steel production during that period. In addition increased use of pellets as blast furnace feed contributed to energy savings.

Conclusion

Sustainable development is a factor of increasing importance in today's industry. The steel industry has in the past fifty years experienced a steady growth of production from 200 million tons in 1950s to 13345 billion tons in 2007. There is no way of reducing CO_2 levels to where the scientists say these should be by 2050, unless radical new ways of making steel, the so-called breakthrough technologies, are identified, developed, and introduced. Technological advancements in the steel industry that have taken place over the past 25 years have made substantial reductions in CO_2 emissions possible. These advancements include enhanced energy efficiency in steel making process, improved recycling of steel products, improved use of by products from steel making and better environmental protection techniques. Steel industry has undergone radical restructuring and has become more global, more efficient and more financially viable. India is the fourth largest producer of crude steel and the largest producer of sponge iron in the world. However, in terms of techno economic efficiency of operations our steel

making units are nowhere near their global competitors. To improve the performance of this industry and make it sustainable it is necessary to address basic structural constraints and work towards development of a socio-economic model that would preserve and protect the environment. This would mark the culmination of a social scientist's observation and initiation of an engineer's genius.

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Acronyms:

THRC Tonne of Hot Rolled Coil
CAGR Compounded Annual Growth Rate
HRC Hot Rolled Coil
JPC Joint Plant Committee

Table – 1: Growth in Steel Consumption

(million tons)

Country/Year	2010	2011	2012	2013
China	598.0	624.0	648.9	674.8
U.S.A	79.9	89.2	94.2	99.5
Japan	63.5	64.1	63.7	62.3
India	64.0	67.7	72.5	79.3
World	131.2	1373.3	1422.3	1485.7

Source: WSA Short Range Outlook (April, 2012)

Table - 2: Global Ranking of Indian Steel

Country	Production (MTPA) (2010-11)
China	683.26
Japan	107.59
U.S.A	86.25
India	72.2
Russia	68.74
South Korea	68.47

Source: W.S.A Report 2011

Table - 3: Trend of Steel Consumption in India

Year	Consumption (million tons)	Year	Consumption (million tons)
1951 – 52	1.227	2005 – 06	39.200
1984 – 85	8.848	2006 – 07	44.328
1994 – 95	18.661	2007 – 08	49.420
1999 – 00	25.100	2008 – 09	48.988
2004 – 05	34.389	2009 – 10	52.786

Source: JPC Reports, 2011

Table - 4: Variation in Raw Material with respect to Steel Prices

Average Price (US$)/THRC Price	HRC Price	Iron Ore	Coking Coal
2009	469	85	170.7
2010	614	153	242.7
2011	714	183	288
CAGR Variation (2009-11)	23.40%	46.70%	30.20%

Source: Ernst and Young Analysis

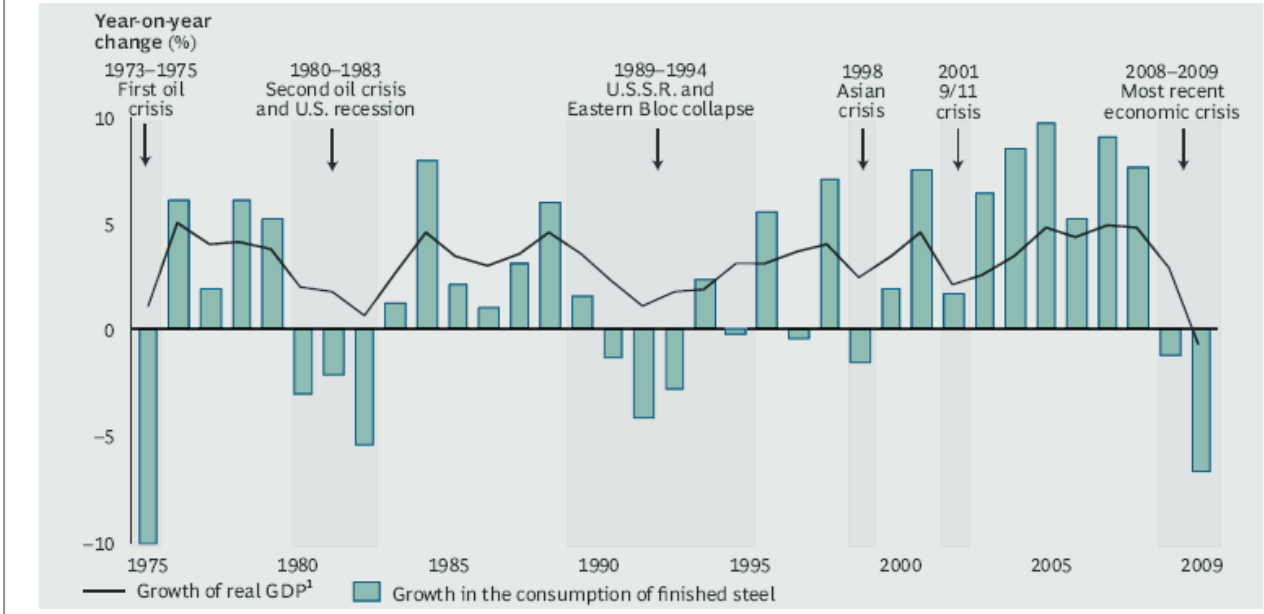

Fig. 1: Cyclical Nature of Steel Industry (Source: WSA, EIU Country Data BCG Analysis)

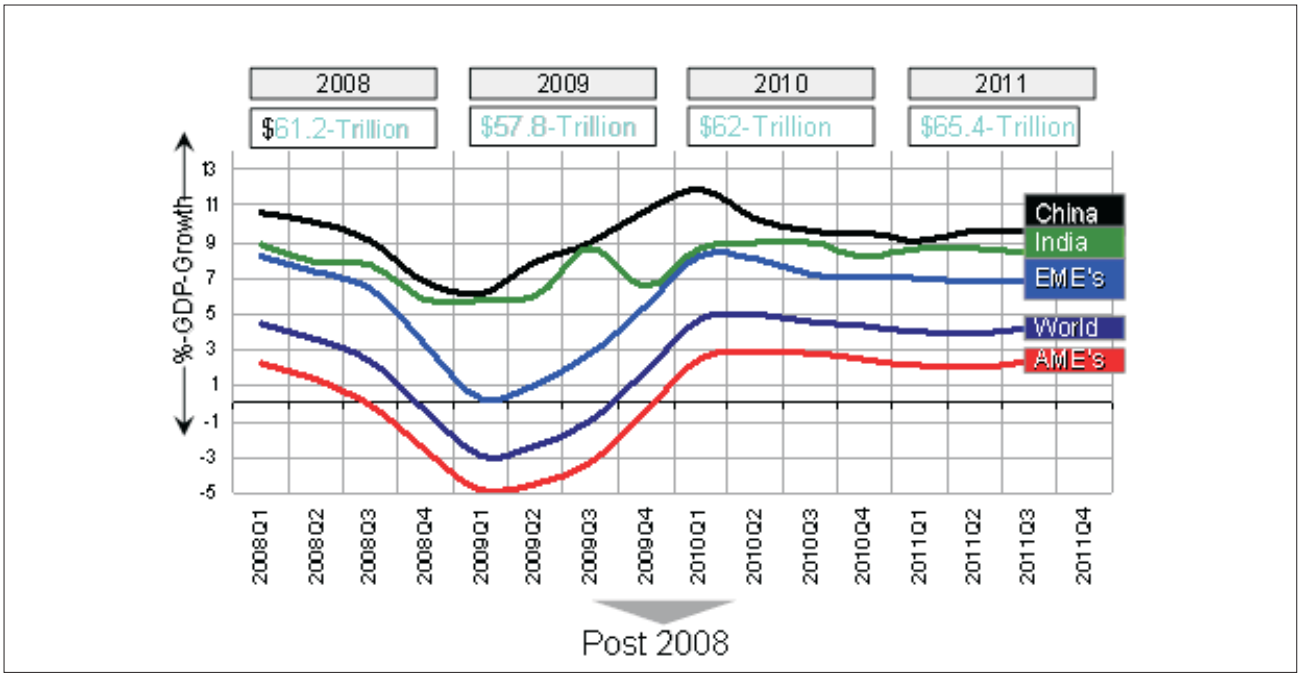

Fig. 2: The Global Steel Scenario (Source: WSA)

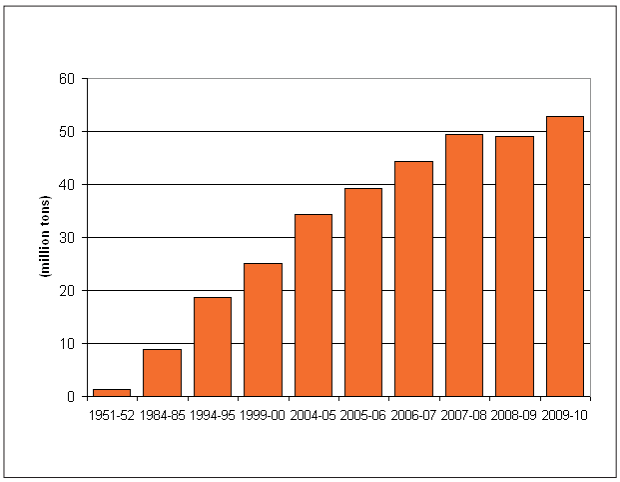

Fig. 3: Trend of Steel Consumption in India

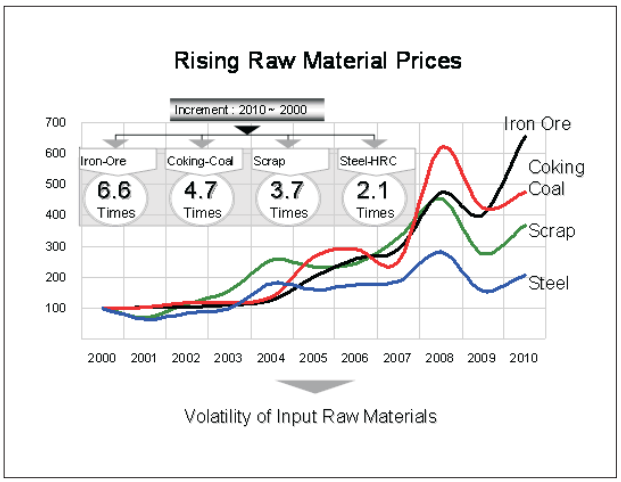

Fig. 4: Raw Materials - volatility with price rise

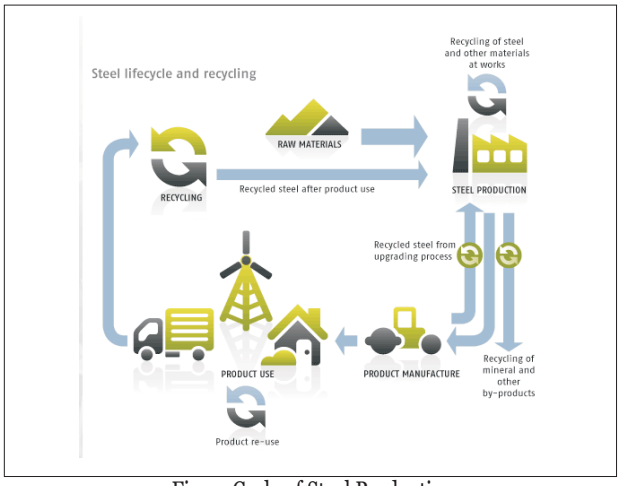

Fig. 5: Cycle of Steel Production

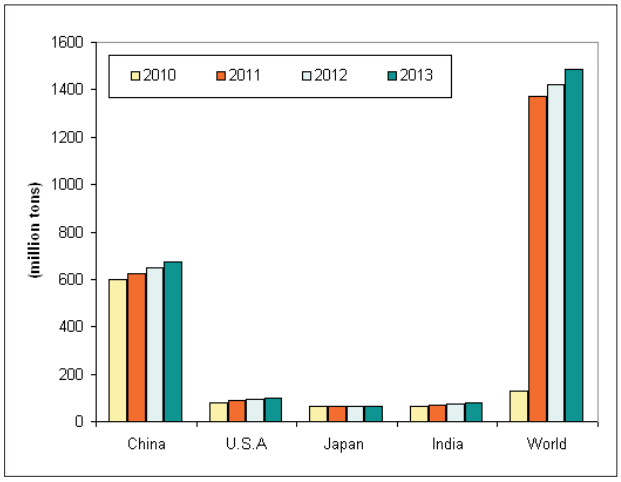

Fig. 6: Trend of Steel Consumption

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