

# Green Manufacturing Initiative by Industries and Government Regulatory Authorities in Indian Iron and Steel Sector

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**Abstract—** Green Manufacturing has got vital importance in Iron and Steel Industries due to consumption of scarce fossil fuels and of polluting global environment by releasing solid, liquid and gaseous pollutants to their surroundings due to huge requirement of steel now a days in India. This paper focuses on necessity, Techniques of GM, and specially action taken by Indian Government in the realm of Air and Water Acts in Indian Iron and Steel Industries. It also emphasizes the appreciation by Centre for Science and Environment (CSE) by Green rating Project.

**Keywords—** Green Manufacturing (GM), CSE, emissions, Acts, GHGs, CCT, PCT, PRT

## I Introduction

**Green Manufacturing:** Green Manufacturing organizations manufacture products using materials and processes that minimize negative environmental impact, help in the reduction of greenhouse gases (GHGs), conserve energy and natural resources, improve safety for consumers, communities and employees and at the same time increase profitability of their organizations as a whole.

Green Manufacturing is a method for manufacturing that minimizes waste and pollution. These goals are realized through product and process design. Green Manufacturing is actually more of a philosophy rather than an adopted process or standard.

In Green Manufacturing, environmental impact of all stages of Production is considered. The manufacturer will not use any Materials which are harmful to the ecosystem in the design, Production, field application and end of life disposal stages of The product.

## Necessity of Green Manufacturing in Indian Iron Industry:

Indian Steel Industries have always played a crucial role in the socio-economic development of a country. They have Contributed primarily to increased prosperity, greater Employment and livelihood opportunities. On the other hand, industries are accused of accelerating the consumption of scarce fossil fuels and of polluting the local, regional, and global environment by releasing solid, liquid and gaseous pollutants to their surroundings.

Steel is also a mature basic material and is one of the most environmentally benign mass products due to its high Recycling rate and comparatively low quantities of energy Required for its making. However, the emission of CO<sub>2</sub>, is a Serious problem for steel industry because steel industry relies

Heavily on fossil fuels as energy source and limestone for the Purification of iron oxides. Steel industry contributes around 6-7% to total anthropogenic emission of CO<sub>2</sub>. Steel works Now face with the increasing demand to minimize emission of GHGs.

## II Green Manufacturing Techniques in Indian Iron Industry

### Functions of GM in Iron Industry:

- i. Process improvement to maximize the yield and to help minimize the waste that is produced.
- ii. GHG reduction and Providing a cleaner source of energy through new technology.
- iii. Decreasing energy consumption in process by using Energy saving technologies & Productive efficiency.
- iv. Environmental regulation and production structure for the iron and steel industry.
- v. Increase iron resource efficiency
- vi. Emission Mitigation of CO<sub>2</sub> by CO<sub>2</sub> captures technologies.
- vii. Converting pollutants and wastes into byproducts and promote their utilization and recycling along with the use of the product.

### Some of the Energy saving Techniques being used

#### In Iron and Steel industries:

**(1) Continuous casting technology (CCT)** CCT is an energy efficient casting method that could enhance energy utilization Efficiency greatly. Continuous casting transforms molten metal Into solid on a continuous basis and includes a variety of Important commercial processes. These processes are the most Efficient way to solidify large volumes of metal into simple Shapes for subsequent processing. Most basic metals are mass produced using a continuous casting process, including over 500 million tons of steel in the world each year. The development of CCT not only saves energy, promotes finished steel products rate, decreases cost, but also solves the mutual confining problem of mold casting, initiative roll process.

**(2) Coke Dry Quenching (CDQ)** Coke dry quenching appears as a highly reliable system to reduce air pollution, while it can also reduce substantially energy use, especially when it is associated with a coal preheating. In addition, dry quenched coke is harder and stronger, and its moisture content is much lower than that of wet quenched coke. The coke dry quenching (CDQ) process offers distinct advantages of sensible heat Recovery, conservation of water and zero air and water pollution.

The dry coke produced in the process enhances the productivity of blast furnaces, the work horses of integrated steel plants. Annually, one million cubic metres of water will be saved and, Almost three quarters of million tonnes of steam will be Generated for use in power plants. This technology, commonly Known as CDQ, would have a favourable impact on climate Change issues being addressed under the Kyoto Protocol. The Carbon dioxide emissions into the atmosphere will come down by 140,000 tonnes per year

**(3) Pulverized Coal injection (PCI)** The technology of PCI in blast furnace not only enhances energy utilization efficiency but also increases productive efficiency. PCI is the short form of Pulverized Coal injection. Declining supply of quality coking Coal and escalating prices of coke have led iron and steel manufacturers to seek other carbon-based products to reduce the consumption of the more expensive coke. One solution is the technology of injecting pulverized coal into a blast furnace as an auxiliary fuel to reduce the amount of coke consumed and therefore to reduce operating costs in the production of pig iron and then ultimately crude steel.

**(4) Top Pressure Recovery Turbine (TRT)**  
TRT is the shortened form of Blast Furnace Top Pressure Recovery Turbine. It is a energy recovery turbine by which the Pressure energy and thermal energy of the gas coming from top of the blast furnace is converted to mechanical energy so as to Drive generator to recover the electricity, which is not only Purify the coal gas, but lower the noise pollution. Besides, it, Under normal operation, can replace the septum valves to Regulate and stabilize the top pressure, which can benefit the blast furnace production. TRT is the Energy-saving equipment used for a blast furnace of steel plants.

**(5) Steel Scrap Recycling** It has been identified as an effective means of conserving natural resources. It is more than economically beneficial for steelmakers and also a part of wise management of iron ore resources. It reduces the consumption of valuable minerals like iron ore, coal, limestone and water. For every metric ton of recycled steel scrap, 1.5 tons of iron ore, 0.5 ton of coal, 0.054 ton (120 pound) of limestone and 40% of water normally used in the production from virgin material is conserved. Through this recycling process, not only the resources that are conserved, the natural habitat is also protected for the future.

**(6) Air and Water pollution Prevention through scrap Recycling**

Manufacturing steel from virgin ore involves the emission of Greenhouse gases, which contribute to global warming. Using Recycled steel scrap generates 85 percent fewer emissions Recycling reduces the need for extracting (mining, quarrying and logging), refining and processing raw materials all of which create substantial air and water pollution. As recycling saves energy it also reduces greenhouse gas emissions, which helps to tackle climate change.

**III Green Manufacturing Initiative by Indian Government in Iron and Steel Industries**

Indian Steel Plants are committed to provide a safe and healthy work environment for the employees including contract workers. Occupational Health and Safety (OHS) centers primarily entrusted with preventive, promotive and curative functions. Periodic health checkups are conducted with emphasis of early detection and intervention for work related

health problems. The steel plants have also taken a number of steps to comply with the laid down standards and norms at and around the steel plants addressing thereby the concerns of local communities.

**Action taken by Ministry of Environment on Indian Iron and steel Industries**

**A] Directions under Section 18 (1) (b) of Air Act, 1981 and Water Act, 1974**

Sr.No	Name of Industry	Non compliance	Action taken
1	M/s Usha Martin Ltd., Tatisiwai, Ranchi, CG	PM emissions from CPP, SMS, WHRB exceeding prescribed standards	Directions under Section 18 (1) (b) of The Air (Prevention and Control of Pollution) Act, 1981 were issued to JSPCB on July 16, 2010. The industry was again inspected jointly by ZO (K) and JSPCB in pursuant of complaint received from Shri G.S. Rajukhedi, MP Dhar. Violation are detected Directions under section 18 (1)(b) of Air Act, 1981 and Water Act, 1974 initiated. Follow up letter written to SPCB. No response received. Follow up letter again to SPCB to give current compliance status
2	M/s. Foundry Forge plant, Heavy Engineering cooperation, Ranchi, CG	APCD not operating, Non compliance to effluent standards	Directions under Section 18 (1) (b) of The Air (Prevention and Control of Pollution) Act, 1981 were issued to JSPCB on Feb 09, 2010. Follow up letter written to SPCB. No response received.

3	M/s. Tayo Rolls Ltd., Kharsawa, CG	APCD not operating, Non compliance to effluent Standards, Heavy fugitive emissions	Directions under Section 18 (1) (b) of The Air (Prevention and Control of Pollution) Act, 1981 were issued to JSPCB on November 11, 2009. JSPCB issued Directions under Section 31 of The Air (Prevention and Control of Pollution) Act, 1981 on February 24, 2010. Industry was given three months time to upgrade the pollution control systems.			(Management & Handling)	to SPCB vide letter dated Sep 13, 2011. Follow up letter written to SPCB. No response received. Follow up letter again to SPCB to give current compliance status.
4	M/s. Jindal Steel & Power Ltd., Raigarh, CG	PM emissions from AFBC, BF, PP, SMS, WHRB exceeding prescribed standards, Heavy fugitive emissions	Directions under Section 18 (1) (b) Of The Air (Prevention and Control of Pollution) Act, 1981. To verify compliance status ZO(B) inspected the industry on Feb 1, 2011. Major conditions in the Direction issued are found to be complying.	7	M/s. Lloyd steel industries ltd., Wardha, Maharashtra	PM emissions from acid recovery plant exceeding prescribed standards	It was inspected during 24 June 2011. PM emissions were found to be exceeding the stipulated limits. Direction under Section 18 (1) (b) of the Air Act, 1981 is issued to SPCB.
5	M/s. SKS Ispat & Power Ltd., Raipur, CG	PM emissions from kiln 3,4 & WHRB exceeding prescribed standards, Heavy fugitive emissions	Directions under Section 18 (1) (b) Of The Air (Prevention and Control of Pollution) Act, 1981 on December 23, 2009. To verify compliance status ZO (B) inspected the industry on feb 26, 2011.	8	M/s. Essar Steel Ltd. (formerly Hygrade pellets ltd.), AP	PM emissions from indurating furnace exceeding prescribed standards	It was inspected during 27-28 April 2011. Stack emissions and AAQ were found to be exceeding the stipulated limits. Direction under Section 18 (1) (b) is issued. Follow up letter written to SPCB. No response received. Follow up letter again to SPCB to give current compliance status.
6	M/s. Amiya Steel Pvt Ltd, WB	Heavy fugitive emissions No authorization under the Hazardous Waste	Industry was inspected on June 15, 2011. Direction under Section 18 (1) (b) of the Air Act, 1981 issued	9	M/s. Bihar Sponge Iron Ltd., Chandil, Singbhum, Jamshepur, Jharkhand	Emissions from emergency Cap, Non compliance to effluent standards	Industry was inspected on 26 November, 2008. Directions under Section 18 (1) (b) of The Air (Prevention and Control of Pollution) Act, 1981 were issued to JSPCB on April 24, 2009. JSPCB issued Directions under Section 31 of The Air (Prevention and Control of Pollution) Act,

			1981 on July 16.2009.
10	M/s. NTPC SAIL Power Ltd., Rourkela, Orrisa	Consent expired, PM emissions from boiler exceeding prescribed standards	Directions under Section 18 (1) (b) of The Air Act, 1981 were issued to OSPCB on September 16, 2010. Follow up letter written to SPCB.

**B] Directions under Section 5 of E (P) Act, 1986**

Sr.No	Name of Industry	Non compliance	Action taken
1	MSP Steel & Power Ltd., Jamgaon, Raigarh	PM emission for ferro alloys stack exceeding the prescribed standards, RSPM in Ambient air exceeding the standard, Heavy fugitive Emissions	Notice under Sec 5 of E (P) Act issued on 19.1.12 to submit BG of Rs. 10 Lacs & ensure compliance. BG submitted
2	M/s. Corporate Ispat Alloys Ltd., Siltara industrial area, Raipur	PM emissions from stack of Kiln & WHRB exceeding the prescribed standards, Heavy fugitive Emissions	Notice under Section 5 of E(P) Act issued on 27.07.12 to ensure compliance & submit BG. Confirmed Direction U/S 5 of E(P) Act issued on 25.09.12. BG submitted.
3	Shri Bajrang Power & Ispat Ltd., Urla industrial area, Raipur	Stack emissions from AFBC & WHRB exceeding the prescribed standards, Heavy fugitive Emissions	Notice under Section 5 of E(P) Act issued on 12.7.12. Industry informed compliance. ZO requested for reinspection.

4	M/s. Monnet Ispat and Energy Ltd., Hasaud, Raipur	Particulate Matter emissions from AFBC – I & II were higher than the prescribed limits, Heavy fugitive emissions	Direction under Section 5 of E(P)Act, 1986 issued on 13.04.10 to submit BG. Reinspection by ZO (B) on 25.2.11.
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**IV Green Rating Project by Centre for Science and Environment (CSE)**

Centre for Science & Environment, a Delhi based NGO has recently come with a Green Rating Project (GRP) report on the environmental performance of 21 Indian iron & steel plants. Ministry of Steel has looked into this Report in consultation with the steel plants. The report has been taken with a positive spirit by the steel sector for improvement in their environmental performance.

Steel Authority of India Limited (SAIL) has a well structured and robust environment management system in place at all its plants. A multi-pronged strategy takes care of the short and long term schemes for pollution control. These include compliance to statutory norms, benchmarking with respect to national and international best practices, phasing out of obsolete technologies and ushering in new, cleaner and energy efficient technologies.

Sr. No	Plant	Score	Award	Highs	Lows
1	Ispat Industries, Raigad, Maharashtra	40	Three Leaves	India's least energy consuming plant; low water consumption and water pollution ; advanced casting technology	High air pollution; poor safety performance; local fishing community affected due to sea transportation

2	Essar Steel, Hazira, Gujarat	39	Three Leaves	Low specific energy and water consumption; lowest GHG emitter; reuses steel melting slag	Poor safety performance and dust emissions control; noncompliance with CRZ regulations
3	Neelachal Ispat Nigam Limited, Kalinganagar, Odish	33	Two Leaves	Advanced coke oven technology; Power generation from waste energy	Waste water discharge not complying with norms; inefficient utilisation of land
4	Tata Steel Limited, Jamshedpur, Jharkhand	32	Two Leaves	Advanced technology in newer plants; lowest specific energy consumption and solid waste generated among plants using blast furnace technology	Poor solid waste disposal practices; wastewater discharge not complying with norms; high air pollution from some operations
5	JSW Steel, Vijayanagar, Bellary Karnataka	27	Two Leaves	Low specific water consumption; advanced coke oven and steelmaking technology; power generation from waste	Poor safety performance; air pollution not complying with norms; high solid waste disposal

6	Jindal Steel and Power Limited, Raigarh, Chhattisgarh	24	One Leaf	energy	Advanced coke oven technology; low water pollution; new blast furnace with advanced technology	Poor safety performance; poor solid waste management; noncompliance with air pollution norms; poor energy efficiency, poor local community perceptions on environmental performance
7	Bhushan Power and Steel Limited, Sambalpur, Odisha	20	One Leaf	Technologies like dry gas cleaning for blast furnace, sinter cooler waste heat recovery, non-recovery coke ovens	Very poor solid waste management; not complying with air pollution norms; poor safety performance; poor local community perceptions on environmental performance	
8	Welspun Maxsteel Limited, Raigad, Maharashtra	9	No Leaves	Nil	Non-transparent; poor disclosure; high dust emissions	

## V Conclusion

“High energy consumption and pollution” constrains the development of Indian iron industry. Confronted with such bottleneck, Green manufacturing, an advanced manufacturing mode has been considered as an effective mode to solve such problem.

Based on analyzing the present situation of Indian iron industry, it is figured out that the energy saving and emission reduction are possible. Meanwhile, study shows that making use of Green manufacturing, the responsibility of environmental protection can be bear. Enterprise’s sustainable developments can be achieved effectively.

Under the mode of green manufacturing, and Indian Government Initiative not only has enterprise performance been improved, but also social responsibility has been improved.

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