

Sustainability and Corporate Social Responsibility in Green Steel Manufacturing - A Case Study

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ABSTRACT

Sustainability is intended at humanizing the quality of life for every human being at the present and for the generations to come. It encompasses environmental, economic, social dimensions, as well as product sustainability. Secondly, climate change is the most significant challenge of current and future generations. It affects all aspects of our economy, society, and environment. A commitment to environmentally sound practices is part of commitment to act responsibly. Responsiveness of the business activity evolves the social phenomenon linked to social responsibility, it further refers to an organization's obligations to maximize its long-term positive impacts and minimize its negative impacts on society at large. This study takes periphery of sustainability and CSR activities keeping in center making of steel and generation of power. Steel is one of the best materials to use to ensure sustainability (World Steel Association, 2017). Steel is a unique material because it allows itself to be truly recyclable – when steel is recycled it becomes new steel and not an inferior product. Since steel does not downgrade when recycled, it can be re-used over and over again. The impact of making steel can be viewed as an investment in a material which will be used again and again, resulting in making steel a very 'Green' material. Similarly generation of power from waste heat, with the use of proven technology, resulting in minimizing the exploiting the natural resources. This case study is conducted at Hi-tech Power and Steel Limited, Raipur, hereinafter referred to as HPSL, with a focus on understanding the green steel manufacturing concerned with social responsibility. Study reveals how sustainable activities like reduction in CO₂ emissions and optimum utilization of resources lead to sustainable development and promote sustainable Industrial growth by conserving natural resources and preventing the thermal pollution even though no such hard and fast statutory requirement exists.

Keywords

Sustainability, CSR, Green Steel, Power, WHRB, IGBT, Carbon Benefits, CDM

INTRODUCTION

Iron is an essential element in plant and animal life and steel is the most recycled material on Earth. Combined with varying amounts of carbon, iron makes a much stronger material called steel, used in a huge range of human-made objects, from cutlery to warships, skyscrapers, and space rockets, buses to buildings, from canned food to computers, almost everything we see around us is either made of steel or is made using steel. Steel is essential to modern society. India is the world's third-largest steel producer (WSA, 2017). The growth in the Indian steel sector has been driven by domestic availability of raw materials such as iron ore and cost-effective labour. Consequently, the steel sector has been a major contributor to India's manufacturing output. Science has blessed mankind with electricity or in refined term power. It is the key component for modern machines and equipments to facilitate life of human being and modern civilization. Power is vital for lives and society. HPSL has clear vision to create a new world of strength, cooperation and co-existence, growth and development which are sustainable through quality product as well as training of human beings; it reflects commitment for tackling the challenges of sustainability. Company takes its responsibility towards both the environment and its communities seriously, balancing these against the need to make a profit. It is apparent that, concern for environment leads to concerns of the society and it reflects the value based human life to all living beings. Company has put systems in place to meet international standards for environmental management such as ISO14001, implying respecting and protecting the environment as an essential belief and matter of deep concern.

LIERATURE REVIEW

Steel and Power

Steel is a strong metal that is a mixture of iron and carbon, used for making things that need a strong structure, especially vehicles and buildings. Power or Thermal Power is electrical power produced by converting heat into electricity (Collins Dictionary, 2017).

Sustainability

Sustainability or Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland Report, 1987). HPSL defines sustainability as 'an ongoing and balanced approach toward industrial and industrial allied activities, ecological responsibilities and community benefits.' It logically involves taking a long-term standpoint on balancing economic, environmental and social impacts of the business or industrial activities.

Corporate Social Responsibility

A commitment to abide by business ethics is shown in the corporate social responsibility (CSR) policy. Now a days industry are no longer judged exclusively on their capacity to deliver products and services, to fulfill the basic needs of the society, but also on the approach of delivery and the way it impact on the social order and the environment. Corporate social responsibility refers to companies taking responsibility for their impact on society. CSR should be company led and government can play a supporting role through a smart mix of voluntary policy measures and, where necessary, complementary regulation. Companies can become socially responsible by: following the law; integrating social, environmental, ethical, consumer, and human rights concerns into their business strategy and operations (European Commission, 2002).

Corporate social responsibility is defined as a business system that enables the production and distribution of wealth for the betterment of its stakeholders through the implementation and integration of ethical systems and sustainable management practices (Richard, 2011)

According to UNIDO (United Nations Industrial Development Organization), Corporate Social Responsibility is a management concept whereby companies integrate social and environmental concerns in their business operations and interactions with their stakeholders. CSR is generally understood as being the

way through which a company achieves a balance of economic, environmental and social imperatives. It is called as Triple-Bottom-Line-Approach as it is addressing the expectations of shareholders and stakeholders (UNIDO, 2016).

International Organization for Standardization's Guidance Standard on Social Responsibility, ISO 26000, published in 2010. It says: "Social responsibility is the responsibility of an organization for the impacts of its decisions and activities on society and the environment, through transparent and ethical behavior that:

- Contributes to sustainable development, including the health and the welfare of society
- Takes into account the expectations of stakeholders
- Is in compliance with applicable law and consistent with international norms of behavior, and
- Is integrated throughout the organization and practiced in its relationships."

ISO 26000 establishes seven core subjects of social responsibility, all of which are parts of most current CSR definitions: Organizational governance, Community involvement and development, Human rights, Labor practices, The environment, Fair operating practices, Consumer issues (ISO 26000, 2010).

Green Steel

The term "Green" Steel manufacturing could be witnessed in two ways: first, manufacturing of green products, such as renewable energy systems and varieties of clean technology equipments and second is greening of manufacturing, which is nothing but, reducing pollution and waste by

- a) Minimizing natural resource use,
- b) Recycling and reusing what was considered waste, and
- c) Reducing emissions.

Green steel manufacturing is aimed at zero CO₂ emission and carbon free steel, yet it is a matter of limited access of such available technology.

AN OVERVIEW OF STEEL AND POWER SECTOR

Global Scenario of Steel

In 2016, the world crude steel production reached 1630 million tones (MT) and showed a growth of 0.6% over 2015. China remained world's largest crude steel producer in 2016 (808 MT) followed by Japan (105 MT), India (96 MT) and the USA (79 MT). World Steel Association has projected Indian steel demand to grow by 6.1% in 2017 and by 7.1% in 2018 while globally; steel demand has been projected to grow by 1.3% in 2017 and by 0.9% in 2018. Chinese steel use is projected to show nil growth in 2017 and decline by 2% in 2018. Per capita finished steel consumption in 2016 is placed at 208 kg for world and 493 kg for China by World Steel Association (World Steel, 2017).

Domestic Scenario of Steel

The Indian steel industry has entered into a new development stage, post de-regulation, riding high on the resurgent economy and rising demand for steel. Rapid rise in production has resulted in India becoming the 3rd largest producer of crude steel in 2015 as well as in 2016. The country was the largest producer of sponge iron or DRI in the world during the period 2003-2015 and emerged as the 2nd largest global producer of DRI in 2016 (after Iran). India is also the 3rd largest finished steel consumer in the world and maintained this status in 2016. Such rankings are based on provisional data released by the World Steel Association for the above year. In a de-regulated, liberalized economic/market scenario like India the Government's role is that of a facilitator which lays down the policy guidelines and establishes the institutional mechanism/structure for creating conducive environment for improving efficiency and performance of the steel sector (Ministry of steel, 2017).

Domestic Scenario of Power

The Overall generation (including generation from grid connected renewable sources) in the country has been increased from 1173.458 BU during 2014-15 to 1173.603 BU during the year 2015-16 and 1242.010 BU during 2016-17. The performance of Category wise generation during the year 2016-17 was -Thermal Increased by 5.34 %, Hydro Reduced by 0.82 %, Nuclear Increased by 1.34%, Bhutan Import Increased by 7.11 %, Renewable Increased by 24.46 %, Overall Growth rate recorded by 5.83 % (Ministry of Power, 2017).

PROMOTING THE SUSTAINABILITY IN STEEL MAKING AND POWER GENERATION

Background

Since 2004 till the year 2010, the Company was operating 100 TPD X 2 numbers of Sponge Iron Kilns. And there were no use of waste heat contained in the flue gases hence the waste heat is being emitted to the atmosphere. HPSL has set up 8 MT X 2 numbers & 10 MT x 2 numbers of Induction Furnaces and 10 MW captive power plant, out of which 4.5 MW is through WHRB (10 TPH x 2 WHRB- Waste Heat Recovery Boiler) mode. Plant set up based on the Clean Development Mechanism strength whereas remaining 5.5 MW AFBC (35 TPH boiler Coal fired Boiler) power plant is fired with Coal, Char, Dolochar, Coal Fines, Washerey rejects. Presently, Power generation capacity of company is 10 MW. Company has also installed 0.2 MW Solar Power Plant under clean and green energy mission. The power generated is consumed firstly to meet the auxiliary power requirement of the WHRBs and AFBC power plant and mainly used for in house captive requirement for the associated industrial manufacturing activities such as operation of Sponge Iron Kiln and to operate Induction furnaces and Rolling Mill.

Sustainable Decisions for Steel Making and Power generation

HPSL builds ethical and sustainable practices into all areas of its operations. Sponge Iron production is not recyclable, yet the steel produced out of sponge iron is recyclable at the same time it is produced by a process that produces CO₂ emissions. Sustainability revolves around the major challenges to reduce CO₂ emissions which may contribute to climate change. Company took initiative for self reliance in terms of Steel manufacturing using Captive Power. Company aimed at generating electricity by using waste heat contained in the waste flue gases released from 2 numbers of ABCs (After Burning Chamber) from 2 numbers of DRI (Direct Reduction Iron) sponge iron kilns of 100 TPD kiln each. The heat contained in waste gases is being transferred to water, which converts water in to steam in 2 numbers of WHRBs (Waste Heat Recovery Boiler) generating aggregate 20 tones/h of steam, at 67 ata pressure and 490±5 °C temperature. The steam produced is fed into 1 STG (Steam Turbine Generator) through a common header to generate electricity from recovered waste heat. Company has achieved better energy efficiency and resulting in sustainable development in the industry as well as improved the working environment of Sponge Iron making process. The power so generated is used to meet the captive power requirement of the Plant itself. The net result is reduction in the demand of electricity from coal based captive power supply and

resultant reduction in GHG emission; from coal based captive power generation.

Sustainable Technology in Power Generation

WHRB based captive Power Plant at HPSL is utilizing the heat content of flue gases coming out of ABCs of sponge iron kilns. The exhausted flue gases from rotary kilns is received at ABC for further incineration where the waste gas temperature reach about 900-1000°C after ABC. No auxiliary fuel is fired in ABC. The generated quantity and the temperature of flue gas are utilized at the best operating levels. This waste heat produces aggregate-20 tonnes/hr (10 TPH each) of steam through the boiler. The outlet boxes of the WHRB, leads to ESP to remove SPM from exhaust gases. The exhaust gas temperature is kept at less than 180 °C. The high pressure steam from WHRB is used to operate high efficiency extraction cum condensing multi stage STGs to generate 4.5 MW Electricity from WHRB. Ash collected from both WHRB hoppers and ESP is conveyed to ash silo. Other systems implemented for the power generation are circulating water, de-mineralized water plant, Instrument Air Compressor and Exhaust Steam Condenser. Only DM (De-Mineralized) water is used in boiler to avoid scale formation on boiler tubes. Total Waste water is recycled and reused after treatment. The technology is environmentally safe and abides all legal norms and standards for SPM, emissions.

GREEN STEEL MANUFACTURING VS. CORPORATE SOCIAL RESPONSIBILITY

Green steel manufacturing has some noticeable advantages in comparison with traditional approach of steel manufacturing practice. Traditional manufacturing mode of operation characteristics as adherence to production, consumption and disposal in mass, which caused severe pollution, such as smoke, dust, waste water and waste residue. HPSL has adopted advance manufacturing mode in 9 years of operation. They have developed a concept of resource management, for instance, they believe that pollutants are the resources that could be placed on the right place. Besides these advantages, there exist some indivisible relations between green manufacturing and corporate social responsibility. In present global and competitive era it has been proved that the energy utilization and pollution generation is very high in traditional manufacturing mode of operation and resulting in threat to social sustainable development. Companies' core competency has been reinforced, and its development has also been speeded up to a great extent. After inclusion of Industry under PAT-II Cycle by Government of India,

under Energy Conservation Act 2001, HPSL has got benchmark for energy conservation and energy efficiency. Utilization ratio of resource and energy has significantly increased and environmental quality has principally enhanced. In a word, green manufacturing process not only brings the economic, social and environmental benefits, but also improves organization's technical innovation ability.

Effective Control Method for making Green Steel through Induction melting furnace

Induction melting furnace is widely used in metal industry for melting or heating slab or rod in continuous casting plant because of good heating efficiency, high production rate and clean working environments. Induction furnaces have very high power consumption and non-linear characteristics. Output power obtained from the coil of this induction heating furnace is not constant. When load side impedance and source side impedance is equal that time resonance condition is occurs. For the constant output of furnace initially controlled through three-phase rectifier, then the switches of inverter converted into IGBT switches and for trigger of these switches, unipolar PWM method is used. An insulated-gate bipolar transistor (IGBT) is a three-terminal power semiconductor device primarily used as an electronic switch used for high efficiency and fast switching. It switches electric power in many applications: variable-frequency drives (VFDs), electric cars, trains, variable speed refrigerators, lamp ballasts, air-conditioners and even stereo systems with switching amplifiers (Wikipedia, 2017). The IGBT based control panel for induction melting furnace is implemented in HPSL resulting in making of green steel.

RESPOSIBILITY TOWARDS PROTECTION OF ENVIRONMENT

Concerns for the environment involves proper disposal of the large amount of fly ash generated from the coal based power plant. Issue is addressed through strategies to promote environmentally sustainable power generation.

Implementing Fly Ash Utilization Action Plan

In India, Coal based power stations (144 Thermal Power Plant) generate around 85.48 million tones of fly-ash per annum. Fly ash is captured by mechanical separators, electrostatic precipitators or bag filters. Appreciating the overall concern for environmental and management issues pertaining to fly ash, which otherwise is a very useful by-product of thermal power plants (TIFAC, 2017). The Fly Ash Mission of TIFAC has made several practical

recommendations for fly-ash utilization in the manufacture of cement, bricks, road and embankment construction, pavement materials, floor tiles, wall panels, and in agriculture, road construction, land-filling and back-filling of underground mines. With the various ways of utilizing the fly ash HPSL has utilized it fly ash as per the TIFAC norms, proving the concern for environment protection.

Implementing Clean Development Mechanism (CDM)

To address increasing concerns related to the environment and to improve environmental performance HITECH CDM CPP is registered with UNFCCC- United Nations Framework Conventions for Climate Change Since March, 2008 vide its Project Proposal no 1693 (UNFCCC-CDM, 2010). Methodologies Used for the CDM is ACM0004 version 2 – “Consolidated methodology for waste gas and/or heat for power generation” with Amount of Reductions 31,209 metric tonnes CO₂ equivalent per annum.

EMS Certification

Environment Management is a high priority area in HPSL and Policies have been formulated to ensure generation of green power. Through persuasion of sound environmental management systems have been accredited with ISO14001 certification. The focus and emphasis is on generation of power in line with global standards and in complete harmony with the environment and nature.

PAYBACK OF TAKING RESPONSIBILITY FOR SUSTAINABILITY

Sustainable practices are often the best business options for the industry. HPSL has witnessed benefits of taking responsibility for sustainability; it includes not only an enhanced reputation which, in turn, leads to greater customer loyalty but also to satisfy the demands of a range of stakeholders. Company has achieved socio-eco-techno and environmental benefits.

Carbon benefit

The main carbon benefit from the implementation of WHR facilities arises from the replacement / displacement of an equivalent amount of electricity to the extent of 4.5 MW electricity generated from steam which will be produced from waste heat recovered from waste gases in two WHRBs, which would have been otherwise generated by increasing the capacity of the Boiler of the coal based captive power plant, at the same time the heat contained in

the flue gases would be continually let to the atmosphere without any utilization, as the company has no other use for the waste heat and there is no legal requirement to recover the heat for any other use-full purpose. The total CO₂ emission reduction, since 2010 for the period of 8 years, is 279672 Ton CO₂ equivalent.

Social benefit

At present state government has surplus power, looking back to the year 2008-09, CSPDCL grid has been facing Power deficiency in the state between generating capacity and demand of electricity from grid; leading to import of electricity from central grid and other sources. Hence the decision to install CPP project contributed in not increasing the deficit, by not demanding any further power required for its steel melting facilities would rather help in reducing this deficit by giving the surplus power to state grid. This enabled the state grid to satisfy more consumers leading to more employment for skilled and professional people in the state. The project also increased the employment within and outside the company for skilled manpower and professionals as well as for semi skilled & unskilled manpower also.

Economical Benefits

Reciprocally generation of revenue by the state, out of the manufacturing activities, is supported because of the captive power generation by way of taxes and cess.

Environmental Benefit

The waste heat recovery CPP in HPSL displaced /replaced the coal based AFBC Captive power generation; thus this project saved further depletion of natural Coal reserves and reduction in CO₂ emission which would have been otherwise emitted into atmosphere while generating electricity from coal based captive power plant. As the activity is based on the utilization of Waste heat from flue gases coming out from process to generate steam required for, waste heat based Power Plant and thus effectively saving environment of thermal pollution and CO₂ emission. Moreover, the waste heat based power generation activity does not consume coal thus there is no generation of any solid waste like fly ash which would otherwise be generated on consumption of coal. The disposal of fly ash has been a serious environment concern. Thus the Environment is also benefited by reduced solid waste problem.

Technological Benefit

- a) Use of waste heat from flue gases coming out of ABC, which is otherwise let in atmosphere without any processing proves and promotes the sustainable technology growth in the industry. Adoption of Air Cooled condenser also helped to further disseminate the water conserving technology.
- b) Reduction of 37% of Transmission & Distribution Losses of Power.
- c) Recycling of 100 % waste water in sponge iron cooling helped to save water resource.
- d) Reduction in SPM level & thermal emission in to the Atmosphere as ESP efficiently removed the ash from Flue Gases which is being collected in Ash Hopper.

COMMUNITY AND VILLAGE DEVELOPMENT AS A PART OF CSR

CSR is generally understood as being the way through which a company achieves a balance of economic, environmental and social imperatives. As a corporate responsibility, presently 3 surrounding villages have been adopted by the company. Company has made substantial investments for nearly a decade in them to make them fully self reliant, providing them fresh drinking water, enhancing their income standards by imparting vocational training, community development and helping poor family for the daughter's marriage. Company firmly believes that the only vehicle for raising the villagers from their present state is by Educating the young and the old, a focus on providing Financial supports for opening schools, Construction of Boundary Wall, Health Check-up Camp, Blood Donation Camp as well. CSR activity is also implemented through the activity assigned by the state government, like wise skill development assistance to ITI and computer training to girl child under vocational guidance program. For the sole reason of up-liftment of Villages, company has provided assistance to inhabitants by means of Construction of Road, Infrastructural development, like construction of community hall, religious place of worship, Balwadi, Homeopathic Dispensary, Drinking water facility and plantation.

CONCLUSION

Hi-tech Power has shown its' commitment for sustainable and environmental practices as part of its overall aim to act responsibly. It reflects proactive steps towards

answering targets of sustainability. HPSL adhered to core values of business ethics and are evident in everything that it does and drive the ethical behavior of the company. Sustainable activities carried out by taking responsiveness to adopt new technology and promoting technological excellence by preventing the thermal pollution. Company has achieved its' goal to be self reliance on power generation by mean of utilizing waste heat energy, it has met the power requirement without any significant transmission and distribution losses as well as less dependency on grid supply of electricity. The key to success approaches recognition of unique properties of steel as a recyclable material and to ensure that measurements of sustainability are taken over the entire life cycle of a product, not just the use phase, making it green steel. Company has upgraded technology to achieve sustainable industrial growth in state, conserved natural resources and environment and promoting the sustainable development. Additionally, captivating these ethical and sustainable approaches helped the company to leverage its position and supported sustainable decisions making initiatives. CSR helped company to reduce costs by means of reduction use of energy and fuel as well as satisfying the need of stakeholders as CSR is grooming 'green'. The soft payback is also felt by employees, who are motivated to work for a company.

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