GREEN STEEL MAKING - Gas Based Technology for Sponge Iron Industry

(By Welspun Maxsteel Ltd)

Worldwide, there is an increasing emphasis on environmental issues. In the area of gaseous emissions, the Kyoto Protocol & recently held Copenhagen summit 2009 has put great pressure on the industrialized countries to reduce emissions and almost all nations are in agreement. This protocol has put tremendous impact on manufacturing industries across the globe and Iron & steel sector is one of the most prominent one.

Iron & Steel industry is growing globally & so are its related environmental issues. This industry is now under intense scrutiny because it emits about 7% of global anthropogenic carbon dioxide. Iron making and steelmaking are energy intensive and essentially all the carbon entering a steel complex leaves as CO2. Although the steel industry has reduced energy consumption and emissions significantly, much more will be required.

Worldwide steel is manufactured by two routes namely Primary and Secondary Route

Primary Route uses Blast Furnace / Basic Oxygen Furnace for steel making, which is a traditional route of steel making. Iron Ore and Coke is main raw material in this process, leading to high Carbon emission in environment. While on the other side Secondary route uses Electric Arc Furnace / Induction furnace for steel making and uses Scrap, Pig Iron and Sponge Iron (HBI /DRI) as key raw materials. Steel produced by Primary route accounted for around 70% of global production and the rest through Secondary route, however after realizing the environmental impact and stringent guidelines laid by Kyoto protocol question arises of “How To Lower Iron and Steel making Carbon Emission”

On a macro basis, there are three ways to lower CO2 emissions from iron and steelmaking production

1) Reduce energy consumption so that less energy (and carbon) is required per ton of steel produced, 2) sequester the CO2 produced underground, either in storage or for enhanced oil recovery, and 3) use an energy source with less carbon than coal.

Option 1) has been a serious focus for many years. Since 1980, the USA steel industry has reduced energy consumption per ton of steel 45 percent. However, further gains are increasingly difficult as the processes become more and more efficient. Option 2) is being studied and there is promise, but it does nothing to reduce emissions from the iron and

steelmaking processes, it just reduces the CO2 emitted to the atmosphere. Also, there are significant practical limitations . Option 3) hold the most promise for significantly reducing carbon emissions. An attractive energy source is natural gas.

Natural gas is primarily methane, with a chemical formula of CH4. Thus, there are four hydrogen atoms for each carbon atom. Coal is a diverse mixture of compounds, but it has a higher proportion of carbon to hydrogen than does natural gas. Since almost all the carbon and hydrogen used in an iron and steelmaking facility are eventually converted to CO2 and H2O (water), natural gas produces much less carbon dioxide than does coal. Table below shows the CO2 emission rates for combusting methane versus two types of coal.

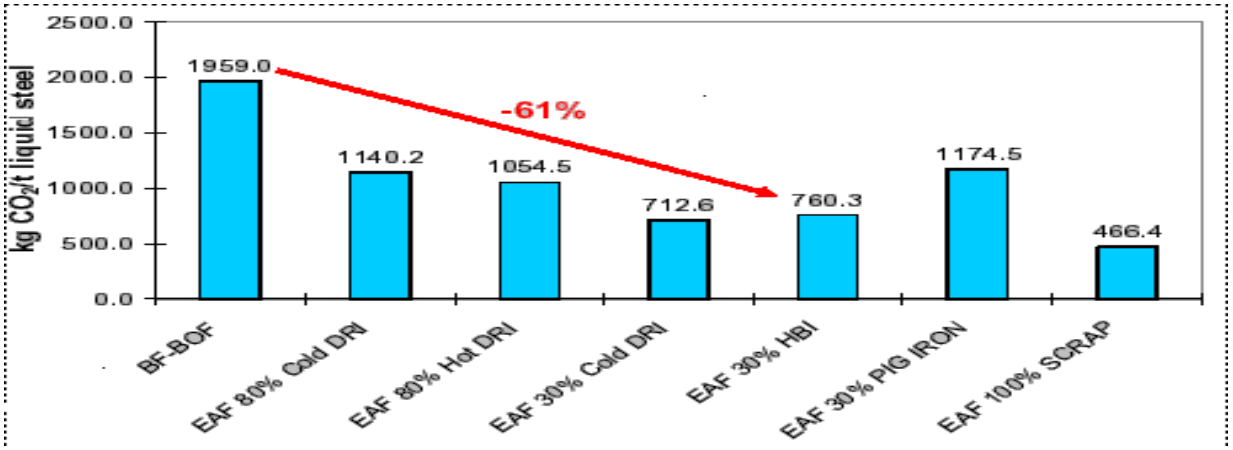
CO2 EMISSIONS FOR IRON AND STEELMAKING ENERGY SOURCES

	CO2 Emissions	
Energy Source	**(t/TJ)**	**(lbs/MMBtu)**
Natural gas (CH4)	49	115
Bituminous metallurgical coal	90	212
Bituminous steam coal	94	220

Source: Midrex Tech

As the table shows, natural gas emits only about one-half the CO2 per unit of energy as does coal. This characteristic makes natural gas an ideal energy source for steelmaking. The DR/EAF combination has much lower carbon emissions per ton of steel than does the BF/BOF process.

To highlight the significant emissions advantage of the DR/EAF steelmaking route versus the BF/BOF route, A detailed analysis of various steelmaking methods, including the blast furnace/BOF and the EAF fed with various mixes of scrap plus alternate iron (DRI, HBI, and pig iron) as shown in graph below



Source: Midrex Tech

From graph it is evident that, the lowest carbon emissions result from the use of 100 percent scrap steel in an EAF, however scrap being generated commodity, has quality issues and scarcely available the metalliks to be used for steel making is Gas Based Sponge Iron (DRI/HBI) in combination with steel scrap.

The Liquid steel produced by using Gas Based Sponge Iron along with steel scrap reduces CO2 emission to the extent of 61% compare to BF-BOF route – **Substantial Reduction**

The Green Solution

World steel industry is required to reduce CO2 emissions. The reduction quantities have been set for all countries. Use of Natural gas for direct reduction, combined with EAF steel making is environment friendly. In EAF, CO2 emission is less than 50% of that in BF. .

Regions such as the, Middle East, South America, Russia and India have already discovered the benefits of the natural gas-based DR/EAF steelmaking route. This will result in promising growth of secondary route of steel making**. Gas Based sponge iron (DRI / HBI) is the perfect replacement of scrap and key metallic to "Green Steel Making"**

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