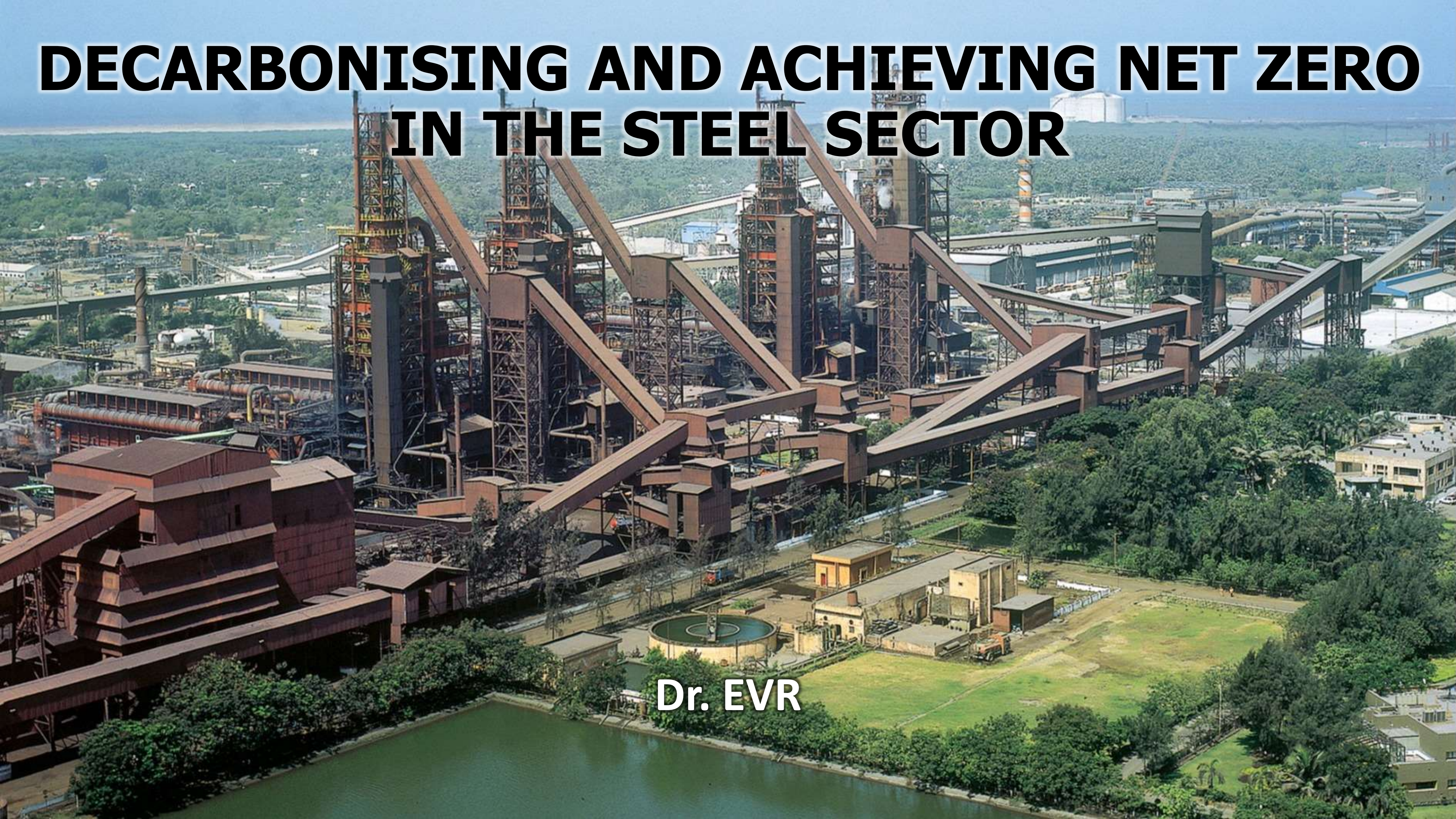
DECARBONISING AND ACHIEVING NET ZERO IN THE STEEL SECTOR



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- The world uses a lot of steel. About 1.9 billion tonnes of steel was used in 2020.
- Bridges, buildings, railways, cars, rockets and wind turbines are all made with steel.
- Auto industry itself uses 12% of the world’s steel.
- In the US, around 10 tonnes of steel is used by person.
- In India the equivalent figure is 0.4 tonnes.
- Global steel demand in 2050 as approximately 2.5 billion tonnes, a 30 per cent increase compared to today.

- Steel production is one of the most energy-consuming industries in the world.
- To make that steel, 3.7 gigatonnes (Gt) of carbon dioxide was emitted to the atmosphere in 2020. 2.6 Gt in direct emissions and 1.1 Gt of indirect emissions which is about 9 % of the world's total greenhouse gas emissions.
- The challenge for the steel sector and the world is to reduce the emissions from steel-making from 3.7 Gt to net zero by 2050.

- Steel can be produced by two main processes:
- Either using an Integrated Blast furnace (BF)/Basic oxygen furnace (BOF) or an Electric Arc furnace (EAF).
- While integrated manufacturers produce steel from iron ore and need coal as a reductant, EAF producers use steel scrap or direct reduced iron (DRI) as their main raw material.

HOW DO WE REDUCE THE EMISSIONS ASSOCIATED WITH STEEL PRODUCTION TO NET ZERO?

- Today, most of the energy used to make steel, whether it’s made from iron ore or scrap, and in a blast furnace, basic oxygen furnace or an electric arc furnace, comes from fossil fuels, in particular, coal or natural gas.
- The electricity used in an electric arc furnace could be generated from renewable sources rather than fossil fuels.
- Over the past 50 years, advances in technology and a move from traditional blast furnaces (BFs) toward the electric arc furnace (EAF) have reduced energy use in steel production by 60%.
- The continued move to EAF will drive down emissions further.
- Improving Energy Efficiency, Resource Efficiency and Material Circularity are other significant options.

Developing & adopting Decarbonization strategies

BF/BOF efficiency programs:

Improve efficiency and decrease production losses by

- optimizing the BF burden mix by maximizing the iron content in raw materials to decrease the usage of coal as a reductant,
- increasing the use of fuel injection through pulverized coal injection (PCI), natural gas, plastics, biomass, or hydrogen,
- using coke oven gas in the BF as an energy source.

These processes may have the potential to decrease carbon dioxide emissions without eliminating them, but do not offer fully carbon-neutral steel production.

Biomass reductants:

This process uses biomass, such as heated and dried sugar, energy cane, or pyrolyzed eucalyptus, as an alternative reductant or fuel. However it is relevant in areas where the biomass supply is guaranteed.

Carbon capture and usage:

Carbon capture to prevent emissions entering the atmosphere could help reduce emissions from steelmaking. This uses emissions to create new products for the chemical industry, such as ammoniac or bioethanol. Carbon capture and usage remains technologically premature and to be proven economically.

Make maximum use of scrap:

Increasing material circularity throughout out supply chains using steel is the most cost-effective way of increasing scrap use, which can displace the more emissions primary steelmaking. Scrap use in the BF-BOF route and in EAFs can be increased to reduce energy consumption and GHG emissions. The problem is that the supply of scrap is limited. Scrap currently accounts for around 30 % of the iron bearing input material for steel making, with the remaining 70 % from iron ore.

Optimize DRI and EAF:

This requires boosting usage of DRI in combination with EAF. DRI-based reduction emits less carbon dioxide than the integrated method and enables the production of high-quality products in the EAF.

DRI and EAF using hydrogen:

This uses green hydrogen-based DRI and scrap in combination with EAFs. The process replaces fossil fuels in the DRI production stage with hydrogen produced with renewable energy. It represents a technically proven production method that enables nearly emission-free steel production.

All major European steel players are currently building or already testing hydrogen-based steel production processes.

Hydrogen-based steel production using an EAF is technically feasible and already considered to be part of a potential long-term solution for decarbonizing the steel industry on a large scale.

By-product reuse:

Steel sector generates by-products that are essential to other industries as raw materials.

These include blast furnace slag, which is formed when the impurities from the steel-manufacture process are mixed with limestone and which serves as a binding material in concrete; and water and processing liquids, which are filtered for reuse by the steel plant.

Hot flue gases are collected and cleaned before being channeled to heat the air blast in the furnace.

Steelmaking using electric arc furnaces produces dust and sludges that are processed to recover other metals, such as zinc, for reuse.

Improved ESG performance:

Improving ESG parametrs will reap benefits for steelmakers beyond compliance with regulations and stakeholder expectations.

Companies with a better ESG performance can secure project financing at a lower cost, enhance resources management, reduce operational risk and increase resiliency against future changes. Include the impact of carbon emissions when assessing the profitability of capital investments.

Adopting shadow internal carbon prices can help identify sustainability inefficiencies and the potential impact of a low-carbon economy on costs.


THANK
YOU
Data retrieved from various sources is duly acknowledged