Best Practices in Energy Efficiency

"Iron & Steel Sector"

A Path for Decarbonization

"Today and Tomorrow"

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Energy Efficiency –Iron & Steel Sector –A Path For Decarbonisation:-

India is currently the world's second largest steel producer. The 2017 National Steel Policy of India set out the ambition to quadruple production capacity to 500 MT by 2050. So Carbon dioxide emissions from the steel industry are projected to jump to 837 million tones over the next three decades from 242 million tones.

During the recently concluded COP 26 at Glasgow, Our beloved PM MODI JI had committed India to become net-zero by 2070. But the point is that in India only approx 12% of greenhouse gas (GHG) emissions come from the steel sector ,with every ton of steel produced normally emits on average 2.6 tons of carbon dioxide. Globally our emission intensity is 1.9 ton co2 and this is 7%.

The steel sector has to play an important role in achieving this commitment. Although critical for economic growth, the iron and steel sector is energy- and resource-intensive. Rapid growth of Indian steel demand will have significant energy, environmental, resource and economic consequences.

Today, the iron and steel sector is already the largest industrial sector in terms of energy consumption. Accordingly the development and adoption of energy-efficient and latest technological innovations in steel manufacturing are extremely critical.

Energy Efficiency –Iron & Steel Sector –A Path For Decarbonisation:-

As per national steel policy India will quadruple steel making capacity from 120 million tonnes to 490 million tonnes by 2050.
Energy use in iron and steel making IN IRON AND STEEL MAKING is a significant industry challenge.
SEC as on date:-

- **Integrated Steel Plants in India 6-6.5 Gcal**
- **Steel Plant Abroad :- 4.5-5.0 G.cal**

Higher rate of energy consumption is mainly due to:-

- **Obsolete Technology.**
  - **Problems in retrofitting modern technologies in old plants.**
  - **Old shop floor & operating practices.**
  - **Sub standard quality of raw material i.e high ash coal/coke, high gangue iron ore/pellet etc.**

However specific energy consumption in steel plant is reducing at very fast pace on account of technological upgradation, utilization of waste heat from blast furnace/coke oven, DRI kilns, use of better quality input and process improvements etc.

Conservation is Generation

National Action Plan on Climate Change

The Govt under min of steel and BEE through various schemes encouraging iron and steel manufacturer to reduce energy and doing better environment management. some of the steps /initiatives taken government industry

- **Launched in 2008**
- **8 National Missions –National Mission For Enhanced Energy Efficiency (NMEEE)**
- **Performa Achieve And Trade (PAT)-flagship Scheme Under NMEEE- Effective From April 2012.**
- **Covered 163 Numbers of Iron & Steel Units in India.**
- **Energy Consumption of 20000 Toe Per Year.**
- **Reduction of Specific Energy Consumption (SEC) on a Gate To Gate (GTG) Basis in Cycle 1 and Cycle2 .**

Don’t waste your money. Practice energy efficiency.

Promotion of Energy Efficiency in Small and Medium Sector

(United Nations Development Programme) UNDP and Global Environment Facility (GEF) and Ministry of Steel(MOS) UNDP- GEF-MOS combined project of India.

For Energy Efficiency in Steel Re Rolling Mills (2004-2013).

1. Facilitated low carbon technologies.

2. 34 steel re-rolling mills (modern mills) brought down energy consumption and GHG emissions by 25-50%

UNDP-MOS-AUSAID(Australian Aid) Project

Upscaling Energy Efficient Production In Small Scale Steel Industry In India (June 2013-June 2016)

- **321 Mini Steel Mills.**
- **5 Induction Furnace Units.**
- **Rs 50 Crore From Private Sector.**
- **Rs 20 Crore MOS , AUSAID and UNDP.**
- **Reduced Specific Energy Consumption (SEC) by 20% to 30%.**
- **Reduced About 4,00,000 T Of Co2.**

Reduce, Reuse and Recycle

(NEDO- New Energy & Industrial Development Organization- JAPAN) Model Projects for Energy Efficiency Improvement

Government of Japan through Ministry of Economy Trade and Industry – Overseas Development Aid (ODA)-Green Aid Plan (GAP) through Department of Economic Affairs , Government of India (GOI)

Taken 3 Projects – Two at Tata Steel and One at RINL (Vizag).

- **BF Stove Waste Heat Recovery.**
- **Coke Dry Quenching.**
- **Sinter Cooler Waste Recovery.**

Save fuel, save money

Slag Utilization :- Slag is an important bye product and had found important uses as such made it viable to use in some important applications

- **Half a ton for each ton of steel produced,**
- **Utilizing 100% of the iron slag produced.**
  - **Cement making**
  - **Some portion as aggregate.**

- **However the utilization of SMS Slag is find at times limited use due to:-**
  - **Phosphorus content.**
  - **High free lime content.**
  - **Higher specific weight.**

National Determined Contributions (NDCs) for Indian Steel Industry

- **Reduce the emissions intensity of its GDP by 33 to 35% by 2030.**
- **Ministry of Steel has submitted NDCs for iron and steel in sector.**
- **MOEF & CC (Climate Control) has kept a target to reduce GHG emissions by adopting clean and green technologies.**

Progress Achieved in reducing GHG Emissions.

- **India is on track to reduce the emissions intensity of GDP by 20-25 percent from 2005 levels to 2022.**
- **Based on national green house gas inventory India has confirmed that India has successfully continued growth story decoupling its economic growth to reduce GHG emissions by 20-25%.**
- **India is also implementing one of the largest renewable energy programme of target to achieve 175 GW (GEGA WATT) of capacity by 2023 and later upto 450 GW.**
- **Installed Capacity of Wind Energy -38.12 GWs on 30th sept 2020.**
- **Increase of 1.3 million ha in forest and tree cover between 2015 and 2019.**
- **Total renewable energy is 136 GW(36% Growth).**
- **Solar Power growth is 2.6 TO 34 GW.**

Energy saved is Energy generated.

Perform and Achieve and Trade (PAT) Scheme

1. Launched in 2012.

2. 478 Designated Consumer (DCS)

3. Avoided Emissions of

- ✓**31 Mt CO_2 in cycle 1 (2012-13 to 2014-15)**
- ✓ **13.28 Mtoe , PAT cycle 2 (2016-17 to 2018-19)**
- ✓ **61.34 Mtoe CO_2 had been reduced so far.**

Energy efficiency begins from home.

Achievement of Steel Industry

✓Reduced Co2 emissions intensity from 3.1 T/tcs in 2005 to 2.64 T/tcs by 2020 which is 12% of co2 emission and next Target is 2.4 T/tcs by 2030.

Initiatives taken so far

- ✓ Gradual implementation of latest state of the art clean technologies.
- ✓ raw material quality improvement.
- ✓ improving fuel efficiency.
- ✓ Creation of carbon sink
- ✓ process improvement
- ✓ trainings on energy efficiency.
- ✓ waste and loss minimization.
- ✓ Going for ISO-50001 also helping in improvement in energy efficiency.

The less you burn, the more you earn

Tomorrow:- scope in Energy Efficiency:-

Areas of energy conservations are:-

- ✓ **A –AWARENESS:-Lack of awareness is the first reason, 4-5% can be conserved by awareness and seriousness only.**
- ✓ **R-Raw material :-Low grade iron and coal is the major reason, 60-80% cost goes to rawmaterial. Technology must be developed to convert hot iron pellet directly to DRI through CB route.**
- ✓ **T-Technology :- Energy efficient technology must be established ,though technology cost is high. Technology should be developed to use hot pellet for DRI making , CB DRI to be directly used in induction /arc furnace as we first cool from 1000*c temp to 100* temp and then again heat from 100* to melting temp and in this we loose sensitive energy**
- ✓ **I- Innovations:- No plant can deliver best performances until-unless innovations are done, inefficiencies must be addressed , process and proper combustion plays critical role. Any thing coming out black is money. Micro porus board and insulting refractory should be used for less shell temperature and energy loss.**
- ✓ **S- Sp consumption:- We had to always compare our self with genuine benchmark performance.**
- ✓ **T- Top driven approach:-organization culture comes from commitment from the top. So everyone had to be an energy mgr.**

Don’t take a car, if it’s not that far

Future scope in Energy Efficiency:

Iron Making through Blast Furnace :-

- ✓ Coke Dry Quenching (CDQ) –power generation from the waste heat from CDQ.
- ✓ Sinter plant heat recovery (power generation from sinter cooler waste heat).
- ✓ Top Pressure recovery Turbines (TPT) in blast furnace.
- ✓ Hot stove waste heat recovery in blast furnace .
- ✓ Dry type Gas Cleaning (GCP) in blast furnace.
- ✓ Converter/gas recovery in BOF
- ✓ use of high grade coal/coke
- ✓ use of high grade iron ore pellet and high Fe(t) (+65) and low gangue alumina and silica.

Rolling Mill:-

- ✓ Cast steel direct feeding to rolling mills Should be ensured across the nation.
- ✓ Direct rolling mills eliminates the need of reheating furnace.
- ✓ Technology must be developed to capture all heat during casting and caster to rolling mill.

Energy efficiency is a journey, not a destination.

Future scope in Energy Efficiency:-

Electrical:-

- ✓ **Variable voltage frequency (VVF) drives for all high capacity electric motors.**
- ✓ **All electrical procurement should be done with 5 star rating for less energy consumption.**
- ✓ **All lighting should be replaced with LED lights.**
- ✓ **Where ever possible –Solar panels to be installed for solar power , even possibility to be explored to put solar panels on all over vehicles roof .**

Energy Management Practice:-

- ✓ **Awareness and knowledge at all level for a culture driven approach to conserve energy**
- ✓ **Full fleshed developed Energy monitoring cell and Energy management system.**
- ✓ **Energy efficient organization can go for ISO-50001 “Energy management certification”.**
- ✓ **Energy conservation is energy generation had to be culture of the organization.**

Saving energy TONIGHT will make TOMORROW bright

Path for Decarbonisation :-

Use of Carbon Capture, Utilisation and Storage

Steel plants make ideal candidates for carbon capture because most of their emissions can be captured directly from their process-gas and off-gas. This captured carbon can be sold back into the market, enabling producers to keep their costs low while making substantial progress towards global net zero objectives or it can go into safe long-term storage. The captured CO2 from steel plants can be harnessed as a raw material, for example, by combining with water and steel slag to create building materials.

Tata Steel has installed India's first blast furnace carbon capture plant in 2021 which captures 5 tonnes of CO2 per day which is reused on site.

Use of Syngas

Syngas is usually a product of coal gasification and the main application is electricity generation. Using the syngas is potentially more efficient than direct combustion of the original fuel. Syngas may be used to generate a high quality reducing gas for production of DRI.

This technology is being used by JSPL's steel plant at Angul, Odisha.

Use of Green Hydrogen

Green hydrogen-based steelmaking can reduce our import dependence on coking/non-coking coal and make India self-reliant. Replacing coal by hydrogen generated with renewable energy (Green Hydrogen) would make it possible to largely decarbonise the industry.
At current price levels, replacing coal with hydrogen would drive up the price of steel. This gap will likely narrow in the coming years, and could disappear by 2030, as carbon and carbon-emission pricing could drive up the cost associated with the use of coal on one side, while, on the other side, the decreasing costs of renewable electricity, efficiency gains resulting from larger-scale production of hydrogen, and optimisation of the hydrogen-based steel-making processes will drive down the costs of this alternative. India can become a leader in Green Steel production as big corporates had started entry in hygrogen business .

Use of Solar Power

Traditional steel production uses large amounts of fossil fuel energy to generate the temperatures needed. The energy generated from fossil fuel can be replaced by energy generated by Solar Power in Steel Plants in India's main steel producing states like Odisha & Chhattisgarh, both of which have abundant sunshine. Solar power has an added advantage of being the lowest cost power in India today as well.

Today's wastage is tomorrow's shortage

Through Adopting Energy Efficiency Measures:-

The steel industry is exposed to international competition and energy-efficient steel production can be a competitive advantage apart from reducing the energy consumption. Improving energy efficiency is one way for process industries to reduce costs, and energy-saving technologies can be attractive from a business point of view. Improved energy efficiency can be achieved by adopting more efficient technologies, energy recovery in the manufacturing process, increased energy conversion efficiency, and optimisation of operational practices.

Through Recycling Steel Scrap :-

Recycling steel reduces the need to mine for more ore and saves energy while lowering greenhouse gas emissions. Steel can be recycled an infinite number of times and it doesn't lose any of its properties in the process. This takes a non renewable resource and makes it renewable. Steel recycling uses roughly half the energy of primary steel production, which mean less carbon emissions.

The less you burn, the more you earn

The Future of Green Steel Production:-

Given the massive global demand for steel, the need for hydrogen and renewable energy required for green steel production is just as significant.

According to AFRY and the International Renewable Energy Agency, meeting global steel production in 2021 using the green steel method would require 97.6 million tonnes of hydrogen.

And for a truly carbon-free transition to green steel, the energy industry will also need to focus on green hydrogen production using electrolysis. Unlike methods which burn natural gas to release hydrogen, electrolysis entails the splitting of water (H_2O) into oxygen and hydrogen using renewable energy sources.

Full green steel production would therefore use green hydrogen, electrolysers running on renewables, and additional renewables for all parts of the supply chain:

Currently, green hydrogen production costs are higher than traditional fossil fuel methods, and are dependent on the levelised costs of renewable energy sources. This means they vary by region, but also that they will reduce as production capacity and subsidies for renewables and green hydrogen increase.

And many major European steel manufacturers are already leading the way with pilot and large scale facilities for green steel

Conclusion:-

While iron and steel making will continue to require significant amounts of energy, as discussed, there are clear opportunities in the industry to improve energy efficiency and reduce the use of fossil fuels. Production processes can be decarbonized using electric arc furnaces and with hydrogen-based technology. And, by modernizing applications which rely on electrical systems to reduce inefficiencies, measurable savings in energy use and energy costs can be achieved. Investments in technologies like VSD-motor systems can quickly pay back.

India's decarbonisation strategy has to be a combination of all of the above ways to achieve the ambitious decarbonisation & RE target & to support the Government in building an Atmanirbhar & Green Bharat and finally become net zero by 2070.

Climate change is the greatest threat to our existence

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Thank You!

Strength does not come from what you can do, it comes from overcoming the things you once thought you could not.