ALTERNATE IRON AND STEEL TECHNOLOGIES

LIKELY TRENDS AND SUSTAINABILITY ASPECTS

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PRESENTATION INCLUDES

- PRESENT STATUS OF INDIAN STEEL INDUSTRY
- CONVENTIONAL IRONMAKING
- ALTERNATIVE ROUTES OF IRONMAKING
- STEELMAKING
- ENVIRONMENT AND SUSTAINABILITY
- CONCLUDING REMARKS
PRESENT STATUS OF INDIAN STEEL INDUSTRY
Fifth largest steel producing nation

Around 65 million tons crude steel production in 2010

Accounts for around 5% of world’s total steel production

World Steel Association estimates that India’s steel demand is likely to grow almost by 14 percent annually till 2011.

Prime focus of steel policy

- To attain levels of global competitiveness in terms of global benchmark of efficiency and productivity.
CONVENTIONAL IRONMAKING
The performance level of blast furnace has enhanced remarkably during the last 2 decades leading to higher cost efficiency.

Presently, a single large size furnace produces more than 10000 tons of hot metal per day (tpd).

Notable features of the efficient BF in good International scenarios are:

- Productivity, t/day/cu m (UV/IV*) .. >2.5
- Coke rate, kg/ton of hot metal (thm) .. <300
- Coal rate, kg/ton of hot metal (thm) .. ~200
- Silicon content, % .. 0.3
- Sulphur content, % .. 0.020
- Utilisation, % .. >98%
- Campaign life, years .. >15

* UV/IV – Useful volume/Inner volume
The performance level of Indian blast furnaces compared to global benchmark is low due to:

- Lower size of blast furnace
- Inferior quality of raw materials and coke
- Low level of top pressure
- Lower hot blast temperature
- Lower coal injection rate with inadequate oxygen enrichment of blast.
● Measures to improve performance level of Indian blast furnace
  - Installation of large size modern blast furnaces
  - Upgradation of several existing blast furnaces
  - Improvement in raw material quality
  - Use of high proportion of good quality imported coking coal for coke making.
  - Installation of bell less top charging system
  - Improvement in cooling system
  - Effective monitoring and control system
ALTERNATIVE ROUTES OF IRONMAKING
Major objectives of the Alternative Ironmaking processes are:
- To provide an alternative to traditional BF ironmaking
- To do away with the requirement of metallurgical coke as prime reductant and heat source.

There are two types of alternative processes available:

- Direct reduction (DR) processes
  - Coal based
  - Gas based

- Smelting reduction (SR) processes
DIRECT REDUCTION PROCESSES

- Commercial coal based DR processes adopt either rotary kilns or rotary hearth reactors; capacity limited.

- ITmk3 plant (Cap. 500,000 tpy iron nuggets) based on rotary hearth process has been commissioned at Minnesota, USA in 2010.

- Commercial gas based DR processes adopt a single vertical reactor; have higher thermal efficiency & greater benefit of economies of scale compared to coal based DR processes.
SMELTING REDUCTION

- SR is the process which carry out reduction of iron oxides, followed by melting where refining takes place in the liquid phase.

- SR process is to provide an alternative to the traditional BF route of ironmaking, and do away with the use of metallurgical coke.
STEELMAKING
PRESENT STATUS
PROCESS-WISE CRUDE STEEL PRODUCTION IN INDIA

Production Percentage

- BOF: Approximately 45%
- EAF: Approximately 25%
- IF: Approximately 30%
- OHF: Approximately 10%
PRESENT AND LIKELY FUTURE

Present

- IF: 30%
- EAF: 24%
- BOF: 44%
- OHF: 2%

Likely future

- BOF: 50%
- EAF: 35%
- IF: 15%
AREAS OF IMPROVEMENT

BOF

- Improved gas cleaning system
  - Reduction in dust content (10-20 mg/Nm3)
  - Economical dust recycling
  - Lower energy consumption

- Online measurement of temp. and com.

- Increased post combustion
AREAS OF IMPROVEMENT (Cont’d)

BOF

- Improved gas cleaning system
- Online measurement of temp. and com.
- Increased post combustion

- Improved process control.
- Reduction in tap-to-tap time
AREAS OF IMPROVEMENT (Cont’d)

BOF

- Improved gas cleaning system
- Online measurement of temp. and com.

Increased post combustion

- Increased scrap ratio.
- Reduction in potential emission of carbon monoxide
AREAS OF IMPROVEMENT

EAF

Oxyfuel burners and high speed oxygen jet

- Fast refining of melt
- Reduced power consumption
- Reduced tap-to-tap time

Online gas temperature and composition analysis

-215779631900471360967843415449855062148934903868435112389147485189401677092945053534423114349948146014656027210306330527884303110246685714735701081286770688x-2374086704336011865988787854595842659824146563906826273214904977229389294880230638726358907204245440506923847278855518433892431859674101548463150662013681664
AREAS OF IMPROVEMENT (Cont’d)

EAF

- Oxyfuel burners and high speed oxygen jet
- Online gas temperature and composition analysis
  - Increased productivity and yield
  - Decreased energy consumption, power on time, operational cost.
AREAS OF IMPROVEMENT
SECONDARY REFINING

Production of steel with low residual element

- Better metallurgical properties like better crack propagation resistance, better tensile strength
AREAS OF IMPROVEMENT
CONTINUOUS CASTING

- Plasma heating of tundish
  - Close control of super heat

- Electromagnetic brake
AREAS OF IMPROVEMENT (Cont’d)

CONTINUOUS CASTING

- Plasma heating of tundish
  - Less mould turbulence
  - High casting speed
  - Better inclusion removal
- Electromagnetic brake
DEVELOPMENT OF ADVANCED STEELS

Steels for automobile industry

Basic property requirements:

- High strength
- High formability
- High strength to weight ratio

TRIP (Transformation induced plasticity) steel, IF (Interstitial free steel), Dual phase steel , Advanced high strength steels (AHSS) fall in this category.

In India, bulk production of TRIP steel is yet to take off.
DEVELOPMENT OF ADVANCED STEELS (Cont’d)

✓ Steel for oil and gas transportation
   Steels having
   - Higher corrosion strength
   - Better crack propagation toughness at low temperature
   - Better corrosion resistance
   are being produced

✓ Steel for boiler and supercritical application
   Steels having
   - Higher temperature resistance
   - Higher strength
   - Higher oxidation resistance
   are being produced.

✓ Transformer steels
   - Steels having lower core loss (Cold Rolled Grain Oriented)
   are being produced.
ENVIRONMENT AND SUSTAINABILITY
Sustainability is optimal use of natural resources and adoption of eco-friendly processes to minimise environmental impact.

This can be attained in three ways:

• Reduction in use of resources in steelmaking itself through development of new production and processing methods.

• Development of new generation of steel with improved properties to meet the stringent requirement of the customer with reduced consumption.

• Environment friendly operation
SPECIFIC ENERGY CONSUMPTION – INDIA VS OTHER COUNTRIES (2008/2009 FIGURES)

Considerable potential to reduce energy intensity in India.
CO₂ EMISSION BY STEEL INDUSTRY–INDIA VS OTHER COUNTRIES
(2008/2009 FIGURES)
EXTENT OF BY-PRODUCTS REUSE—INDIA VS OTHER COUNTRIES
(2008/2009 FIGURES)

India ~ 75%
CONCLUDING REMARKS
Indian steel industry on a robust growth path

- Maintained a upward swing in spite of the global recessionary trends.
- By recent estimates, country’s steel production could rise almost three fold by end of this decade.

The increase in capacity needs to address environmental issues for long term sustainability.
THANK YOU