Benchmarking for Enhancing Competitiveness of Indian Steel Plants

The IIM Delhi Chapter, 15th September ’2017
Presentation Flow

1. Introduction – Need for benchmarking
2. Global Benchmark for Iron & Steel Industry
3. Benchmarking – JSW Steel vs Indian Steel Plants
4. JSW Initiatives
5. JSW Roadmap
Why Benchmarking?

“What you don’t measure, you can’t manage.”

➢ Helps in establishing a standard for comparison.

➢ Helps enterprises to identify inefficiencies and search for more efficient technology / opportunities.

➢ Improve the understanding of a process and help identify best practices.

➢ It improves the skill, knowledge and efficiency of the people

➢ Increased attention for energy-efficiency and performance.

➢ Benchmarking essentially is a measuring Tool and helps in continual improvements.
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<td>JSW Initiatives</td>
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<td>JSW Roadmap</td>
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Global Benchmark for Iron & Steel Industry

<table>
<thead>
<tr>
<th>#</th>
<th>Parameters</th>
<th>Units</th>
<th>Global Average</th>
<th>India Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Greenhouse gas (CO$_2$) emissions</td>
<td>Tons CO$_2$ / TCS</td>
<td>1.90</td>
<td>2.60</td>
</tr>
<tr>
<td>2</td>
<td>Specific Energy Consumption</td>
<td>GCal / TCS</td>
<td>4.85</td>
<td>6.25</td>
</tr>
<tr>
<td>3</td>
<td>Water pollutant discharge</td>
<td>Kg / TCS</td>
<td>Zero</td>
<td>0.10</td>
</tr>
<tr>
<td>4</td>
<td>Blast furnace productivity</td>
<td>T / m$^3$/ day</td>
<td>3.0</td>
<td>2.3</td>
</tr>
<tr>
<td>5</td>
<td>Blast Furnace campaign life</td>
<td>Years</td>
<td>20</td>
<td>&lt; 15</td>
</tr>
<tr>
<td>6</td>
<td>BOF lining life</td>
<td>No. of Heats</td>
<td>12500</td>
<td>6000</td>
</tr>
<tr>
<td>7</td>
<td>BOF/EAF slag utilisation</td>
<td>%</td>
<td>75</td>
<td>30-50</td>
</tr>
<tr>
<td>8</td>
<td>R&amp;D Expenditure/Turnover</td>
<td>%</td>
<td>1.50</td>
<td>0.20</td>
</tr>
</tbody>
</table>

Ref : worldsteel.org and un.org/sustainable development - 2015,
Operating committee meeting on Sinter & BF – 2016
Introduction – Need for benchmarking

Global Benchmark for Iron & Steel Industry

Benchmarking – JSW Steel vs Indian Steel Plants

JSW Initiatives

JSW Roadmap
JSW Steel vs Indian Steel Makers

Source: Operating committee meeting on Sinter & BF – 2016
## Comparison of Indian Blast Furnace Performance

<table>
<thead>
<tr>
<th>Indian BF</th>
<th>Productivity (t/m³/day)</th>
<th>Slag Rate (kg/thm)</th>
<th>PCI Rate (kg/thm)</th>
<th>Coke Rate (kg/thm)</th>
<th>Fuel Rate (kg/thm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tata Steel</td>
<td>BF- H</td>
<td>2.78</td>
<td>295</td>
<td>212</td>
<td>325</td>
</tr>
<tr>
<td>JSPL</td>
<td>BF#1</td>
<td>3.30</td>
<td>412</td>
<td>119</td>
<td>426</td>
</tr>
<tr>
<td></td>
<td>BF#2</td>
<td>2.58</td>
<td>396</td>
<td>145</td>
<td>390</td>
</tr>
<tr>
<td>RINL</td>
<td>BF#3</td>
<td>1.55</td>
<td>321</td>
<td>2</td>
<td>532</td>
</tr>
<tr>
<td>Bhusan Steel</td>
<td>BF#1</td>
<td>1.33</td>
<td>402</td>
<td>113</td>
<td>353</td>
</tr>
<tr>
<td>JSW Vjnr</td>
<td>BF#4</td>
<td>2.88</td>
<td>400</td>
<td>150</td>
<td>395</td>
</tr>
</tbody>
</table>

Source: Operating committee meeting on Sinter & BF – 2016.
Introduction – Need for benchmarking

Global Benchmark for Iron & Steel Industry

Benchmarking – JSW Steel vs Indian Steel Plants

JSW Initiatives

JSW Roadmap
Bench Marking Parameters at JSW Steel

- Specific energy consumption
- CO2 emission
- Waste Utilization
- Value added grades of steel
**Counter measures taken at JSW Steel**

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Measures</th>
</tr>
</thead>
</table>
| **Reduction in Specific energy consumption and CO$_2$ emission** | ➢ Use of Corex export gas in DRI making and Reheating furnaces  
➢ Increased PCI injection in BF (130 to 160 kg/thm) at higher slag rate  
➢ Waste heat recovery at sinter plant through steam generation  
➢ Upgradation of low grade iron ores through beneficiation  
➢ Upgradation of BF1 from 0.9 to 1.9 MTPA capacity HM production (reduced fuel consumption and CO$_2$ emission) |
| **Waste Utilization** | ➢ Slime recovery plant  
➢ Micro pellet plant  
➢ Waste to wealth plant (Fe & C recovery from dust and sludge)  
➢ Mill Scale Briquetting Plant |
| **Value Added Steel** | ➢ Development of automotive 3$^{rd}$ Generation Steels (Ultra high strength steels)  
➢ Development of high grade electrical steels (CRNO Electrical Steel) |
Ore Beneficiation Plant (OBP) -- 20 MTPA processing capacity

**Commissioning**
- 2011
- Designed capacity - 20 MTPA
- Largest beneficiation plant in Asia

**Purpose**
- Upgradation of low and medium grade iron ore to feed agglomeration units

**Benefits**
- Reduced dependency on lump ore as the share of prepared burden is ~90%
- Significant cost saving
- Utilization of domestic low and medium grade iron ore
- Supply of desired feed quality to agglomeration units.

In order to maximizing the utilization of low and medium grade iron ores and to reduce the sp. energy consumption;

- Setting-up of Ore beneficiation Plant
- Plan to set-up large (5500 m³) Blast Furnace
- Usage of 100% pellet as feed to Blast Furnace for better quality and productivity
Slime Recovery Plant (waste utilization initiative)

Commissioning

- 2012
- Designed capacity - 0.50 MTPA

Purpose

- Recovery of Fe from tailing of beneficiation plant and Slime pond.

Benefits

- Waste utilization and Environment protection
- Recovery of 1000 T iron bearing material per day for pellet plant
- Avoids dumping of tailing in slime pond.
- Conservation of natural resources.

Feed to SRP: Beneficiation Plant tailing and Slimes from slime-ponds.

Fe upgradation from 48 to 60 % with weight recovery of ~35%
Micro pellet Plant *(waste utilization initiative)*

**Commissioning**
- 2013
- Designed capacity - 0.60 MTPA
- Avg. production: - 1900 T/day

**Purpose**
- Recycling of Dust (Bag filter dust, ESP dust, Lime & dolo fines, CDQ fines), Sludge and LD Slag fines in Sinter making through micropelletization.

**Benefits**
- Helps comply with environmental regulations on airborne dust emissions
- Reduction of solid fuel by 2 kg/T of sinter
- Use of iron bearing waste (~40% Fe in micropellets)
- Converts heterogeneous waste fines into homogeneous granules
- Spherical shape gives uniform permeability
Waste to Wealth Plant (WWP) – Iron & Carbon Recovery

Commissioning
- 2015 (Avg. production : 500 T/day)
- Designed capacity - 1000 T/day

Purpose
- Recovery and Upgradation of low-Fe sludge and dusts

Benefits
- Simple beneficiation circuit (Two stage magnetic separation).
- Fe upgradation from 40 to 63% with 40% yield.
- Concentrate (63% Fe) used in Pellet making
- Avoids dumping/shifting cost.
- Environment friendly technology
Mill Scale Briquetting Plant (waste utilization initiative)

Commissioning
- 2013 (650 T/day)
- Designed Capacity - 0.20 MTPA

Purpose
- Replace iron ore in Converter
- High Fe input (~65%) and less silica load (~4%) as compared to iron ore
- No Bunker jamming
- No Red fumes
- Improved ID fan performance

Benefits
- Reduce the scrap consumption
- Briquettes for use as Secondary Coolant in Steel Making
Value Added Products

Source: Annual reports of respective plants - 2016

JSW Vijayanagar Works
Make in India - Import Substitute in Automotive Grades

No. of Grades Developed

- FY14: 4
- FY15: 9
- FY16: 12
- FY17: 19

Import Substitute Grades: NPD

Widest Expose Panel Steel
IFHS & AHSS Steel
Expose Panel & AHSS
IFHS & AHSS Steel
HSLA GA & BH Grades
JAZ Super forming

Outer Panel & AHSS bench marked with JFE Steel during Development
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JSW Roadmap
JSW Roadmap

➢ To set-up new Blast Furnace (5500 m$^3$) to mitigate fuel consumption and CO$_2$ emission.
➢ Usage of 100% pellet as feed to Blast Furnace for minimized environmental impact
➢ Plan to upgrade existing BF3 from 4019 m$^3$ to 5339 m$^3$ working volume
➢ Dry slag granulation for heat recovery and power generation

➢ Waste management
  ▪ 100% solid waste recycling (presently @ 88%)
  ▪ Sustaining Zero liquid discharge

➢ Value added product
  ▪ Development of automotive 3$^{rd}$ Generation Steels (Ultra high strength steels)
  ▪ Development of high end electrical steels (CRNO Electrical Steel)
JSW benchmark for value added products

<table>
<thead>
<tr>
<th>GA/GI</th>
<th>JSW</th>
<th>JFE</th>
<th>POSCO</th>
<th>Salzgitter</th>
<th>VAI</th>
<th>Arcelor</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRCA</td>
<td>POSCO</td>
<td>VAI</td>
<td>Salzgitter</td>
<td>JFE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HR</td>
<td>VAI</td>
<td>Arcelor</td>
<td>JFE</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Salzgitter-Germany  Nucor-USA  TATA-Europe

Tensile Strength in MPa
RANKED 6th AMONGST TOP 37 “WORLD-CLASS” STEELMAKERS

*Weighted-Average Score Ranking (highest is most favorable)

SOURCE: World Steel Dynamics - Ranking as on June 2017 (based on 23 parameters)
## Ranking by World Steel Dynamics (based on 23 factors) - June 2017

<table>
<thead>
<tr>
<th>Factor</th>
<th>Weightage</th>
<th>POSCO S.Korea</th>
<th>Severstal Russia</th>
<th>Nucor USA</th>
<th>NLMK USA</th>
<th>NIPPON Japan</th>
<th>JSW Steel India</th>
<th>JFE Japan</th>
<th>Arcelor Mittal</th>
<th>Voest Alpine Austria</th>
<th>Voest Alpine China</th>
<th>Bao-Steel China</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>5%</td>
<td>9</td>
<td>6</td>
<td>7</td>
<td>7</td>
<td>9</td>
<td>6</td>
<td>8</td>
<td>10</td>
<td>5</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Expanding capacity</td>
<td>5%</td>
<td>9</td>
<td>6</td>
<td>8</td>
<td>7</td>
<td>5</td>
<td>10</td>
<td>5</td>
<td>3</td>
<td>7</td>
<td>10</td>
<td></td>
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<tr>
<td>Value-added product mix</td>
<td>5%</td>
<td>9</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>10</td>
<td>7</td>
<td>10</td>
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<td>Conversion costs: yields</td>
<td>5%</td>
<td>9</td>
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<td>10</td>
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<tr>
<td>Energy costs</td>
<td>3%</td>
<td>7</td>
<td>8</td>
<td>8</td>
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<td>6</td>
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<tr>
<td>Cost-cutting efforts</td>
<td>6%</td>
<td>10</td>
<td>8</td>
<td>6</td>
<td>8</td>
<td>7</td>
<td>9</td>
<td>7</td>
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<tr>
<td>Labour cost</td>
<td>2%</td>
<td>7</td>
<td>9</td>
<td>8</td>
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<tr>
<td>Environment and safety</td>
<td>4%</td>
<td>9</td>
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<td>Ranking</td>
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<td><strong>8</strong></td>
<td><strong>9</strong></td>
<td><strong>10</strong></td>
<td></td>
</tr>
</tbody>
</table>

*Source: World Steel Dynamics*
Delivering Growth in Challenging Times

Thank You