DIRECTORATE FOR SCIENCE, TECHNOLOGY AND INDUSTRY
STEEL COMMITTEE

INDIA

RAW MATERIALS OUTLOOK FOR INDIA

Joint India/OECD/IISI Workshop, New Delhi (India), 16-17 May 2006.

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Raw materials outlook for India
- A Review

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Tata Steel

IISI-OECD CONFERENCE
Date: 17th May, 2006

Presentation Outline

Steel Industry
- Global
- Indian

Raw materials for Steel
Policy / Legislation
Infrastructure
Conclusion
Global steel demand poised for robust growth

The Global Economic Forecast: Asia poised to be the emerging power house of growth

- In 2020, the US and China will still be the two largest economies in the world (in PPP)
- India leaves Japan behind and moves up to 3rd place
- India, Malaysia and China will post the highest GDP growth rates (above 5%) over 2006-20
- Ireland, the US and Spain are the rich countries expected to grow the most
**Indian Economy**

- GDP per capita to increase from USD 2500 and USD 5000 in 2020.
- Poverty ratio dropped from 50% of population in 1950 to 26% in 2005.
- Economic growth rate ~ 8%
- Population growth rate of 1.3 - 1.5%
- 33% population below 15 years and 5% above 65 years
- House hold savings rate go up from current 23% to 30%
- 100,000 MW new capacity (90% of present) in next 7 years.
- The Fiscal Responsibility and Budget Management Act
- Literacy standards increase from 18% in 1951 to 65% in 2002.

**Steel Consumption Vs. GDP**

Bubble size represents the population

The growth in BRIC will double the steel demand by 2050

Source: internal analysis
Growth in key sectors will drive the steel demand

We feel the growth trigger has been fired... (Last 3 years GDP growth of + 7.5%)

Production sites will move to regions with both RM source and demand.

Forecasted Growth rate 2005-15
### Indian Steel production likely to triple in next 15 years

<table>
<thead>
<tr>
<th>Year</th>
<th>Crude Steel (mtpa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-01</td>
<td>29</td>
</tr>
<tr>
<td>2001-02</td>
<td>31</td>
</tr>
<tr>
<td>2002-03</td>
<td>34</td>
</tr>
<tr>
<td>2003-04</td>
<td>36</td>
</tr>
<tr>
<td>2006-07</td>
<td>50</td>
</tr>
<tr>
<td>2011-12</td>
<td>70</td>
</tr>
<tr>
<td>2020</td>
<td>110</td>
</tr>
</tbody>
</table>

To realize the above projections, it would be necessary to put in place the right policies as well as alignment of the policies.

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- **Steel Industry**
  - Global
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- **Raw materials for Steel**

- **Policy / Legislation**

- **Infrastructure**

- **Conclusion**
### Multifold increase in Raw Material Consumption

![Graph showing multifold increase in raw material consumption for different materials: Iron Ore, Coking coal, Non coking coal, and Fluxes. The graph indicates a significant increase in consumption compared to previous years.]

### Indian Iron Ore Reserves: Five Zones

#### States

- **A-Orissa, Jharkhand**: Haematite, 62-64 Fe %, 2-4 Alumina %, 0.04-0.1 Phos Max %.
- **B-Chhattisgarh, MP, Maharashtra**: Haematite, 64-66 Fe %, 1.0-4.0 Alumina %, 0.04-0.15 Phos Max %.
- **C-Karnataka**: Haematite, 64-65 Fe %, 2.0-4.0 Alumina %, 0.04-0.09 Phos Max %.
- **D-Goa**: Haematite, 60-63 Fe %, 2.0-4.0 Alumina %, 0.04-0.07 Phos Max %.
- **E-Karnataka**: Magnetite, 35-45 Fe %, 1.0 Alumina %, 0.04-0.07 Phos Max %.

#### Major Mines / Deposits

- **A-Orissa, Jharkhand**: Chiria, Noamundi, Jharia, Kiriburu, Merida, Bokaro, Tumurt, Borahi, Guha, Malangtoli, Gandhidham, Dantali.
- **B-Chhattisgarh, MP, Maharashtra**: Baladidia, Dali, Rajara, Roopgarh, Mahamayra, Aridongri, Surajgarh.
- **C-Karnataka**: Domnal, Ramandurg, Kumarasamwady, NIEB Range, Ettinahatti, Tumti, Belagal.
- **D-Goa**: N Goa, S Goa, Redi.
- **E-Karnataka**: Kudremukh, Bababudan, Kudacharli.
Iron Ore

Production Trend

Indian Resources: 23 bt

Natural iron ore resources can support lump: fines ratio of 20:40 as against current adverse trend of 40:60

The current steel production through BF/BOF:DRI:others is 60:33:7

- Fines are mostly being exported
- DRI route uses 100% lumps, detrimental to mineral conservation
- Economies of scale not available with large number of small players to set up sintering / pelletization facilities
- Increasing use of fines in agglomerates in bigger size blast furnaces can increase its productivity and bring down cost/tss
Increasing DRI production may lead to faster depletion of high quality lumpy ore reserves

Source: Tata Steel analysis

With expected CAGR of ~7% and exports at 50 mtpa, India will become an importer of iron ore in next 40 years.

Most of the iron ore reserves are in reserve forest and environment sensitive areas making the actual availability of reserves much less.
**Imperative – Need for conservation and resource enhancement**

### Challenges
- Selective mining of high grade lumpy ores (DRI).
- Many low volume producers
- Mismatch in agglomeration capacity and fines generation.
- Lower production (33%) routed through beneficiation.
- Increasing exports.

### Conservation ....for future
- Scientific Mining
- Agglomeration capacity
- Use of pellets for DRI
- Beneficiation.
- Technology for using Slimes
- Restricting exports.

### Enhancement ...
- Detailed / Scientific Exploration

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**Indian Coal Reserves**

![Map of Indian Coal Reserves](image)

- Proven: 90
- Indicated: 110
- Inferred: 46
- Total: 246

- Proven: 35
- Indicated: 30
- Total: 65

- Proven: 11
- Indicated: 12
- Total: 23

- Proven: 14
- Indicated: 30
- Total: 44

- Proven: 9
- Indicated: 25
- Total: 34

- Proven: 8
- Indicated: 6
- Total: 14

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*Proven: 8 Billion tonnes*
**Domestic Coking Coal**

<table>
<thead>
<tr>
<th>Coal Reserves, BT</th>
<th>Coking Coal Producers</th>
<th>Washed Coal Ash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semi-Coking</td>
<td>CIL 5.8</td>
<td>BCCL 18%</td>
</tr>
<tr>
<td>Prime Coking</td>
<td>Tata Steel 3.3</td>
<td>CCL 18%</td>
</tr>
<tr>
<td>Non Coking</td>
<td>Others 0.5</td>
<td>Tata Steel 13%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

86% Coking, 14% Non-Coking, 3% Med Coking, 11% Semi-Coking

*The Indian Coal, both coking and non coking is characterized by high ash and low washability index.*

*Geological Survey of India: As of 1.1.2001*

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**Imports of Coking Coal to increase due to low Indigenous availability**

- The additional demand for coking coal will be 70 mt by 2020 for 110 mt steel demand as per national steel policy
- For coking coal, dependence on imports to continue

*Source: 10th Plan report*
**Need to conserve the scarce coking coal resources**

**Challenges**
- High ash
- Poor washability
- Over 40% coking coal used for thermal use.
- 70% demand met through imports
- Low domestic availability*

**Conservation of resources for future use**
- Beneficiating
- Improving washing capacity / efficiency
- Technology using medium coking coal for coke making
- Steel making technology using non-coking coal

**Enhancement of capacity**
- Developing new sources
- Detailed exploration

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*Coal Strategy: Reducing coking coal requirements*

**Mining:**
- Beneficiation technology
- Improving mining / washing process efficiency

**Coke & Sinter Making**
- Quality Coke from semi coking indigenous coal.
- Using low ash imported coal for blending
- Reducing Alumina level in iron ore for improving sinter & BF productivity and reducing coke requirement

**Iron Making:**
- Pulverized Coal Injection using semi/non coking coal
- Tar Injection
- Using more pellets
- Using sponge iron for feed
**Limestone**

<table>
<thead>
<tr>
<th>Limestone Reserves</th>
<th>BF grade</th>
<th>SMS grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>Abundant</td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>160 bt</td>
<td>15 bt</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Current Requirement</th>
<th>Requirement in 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>BF grade</td>
<td>3.1 mt</td>
</tr>
<tr>
<td>SMS grade</td>
<td>7 mt</td>
</tr>
</tbody>
</table>

- SMS Grade available in Rajasthan and Himalayan regions.
- While Environment and logistics constrains Himalayan exploitation, high freight from Rajasthan is adverse.
- Stringent quality requirement further restricts availability

*Therefore, Dependence on imports for steel grade limestone to continue...*

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**Chrome Ore**

<table>
<thead>
<tr>
<th>Cr Ore Reserves</th>
<th>Production Ore</th>
<th>Production Fe Cr</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>11068</td>
<td>18</td>
</tr>
<tr>
<td>India</td>
<td>115</td>
<td>3.2</td>
</tr>
</tbody>
</table>

- Ferro-Chrome industry in India is highly fragmented
- >98% Chrome ore reserves in Orissa.
- Chrome ore tons expected to ~ 10 mt by 2020.
- High conversion cost to Ferro Chrome due to high power cost

*Globally competitive power tariffs to avoid shift to countries where power is cheaper.*
Manganese

<table>
<thead>
<tr>
<th>Mn Ore/Reserves</th>
<th>Production Ore</th>
<th>Production FeMn, SiMn</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>5000</td>
<td>29</td>
</tr>
<tr>
<td>India</td>
<td>406</td>
<td>1.4</td>
</tr>
</tbody>
</table>

- International market for Mn alloys have dipped in recent years
- Manganese ore tons expected to grow to 4.5 mt by 2020
- The usage of Mn alloys for steel making is limited by
  - Low Mn content and high phos in Mn Ores
  - High power cost for conversion

Therefore ....
- Need to explore and develop more high grade Mn resources
- Beneficiation to improve the lower grade coupled with sintering

Source: Mineral Commodities Summary: 2002, IBM

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### Evolution of India’s Regulatory Environment

<table>
<thead>
<tr>
<th>1950 – 1991 – Tightly regulated industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Iron ore reserved for Public Sector Companies</td>
</tr>
<tr>
<td>- Growth subjected to “Industries (Development &amp; Regulation) Act 1951”</td>
</tr>
<tr>
<td>- Pricing regulated by “JPC Price Mechanism”</td>
</tr>
<tr>
<td>- Distribution subjected to controls such as “Freight Equalization Scheme”</td>
</tr>
<tr>
<td>- Foreign Investment discouraged</td>
</tr>
<tr>
<td>- Foreign trade regulated by Canalization policy</td>
</tr>
</tbody>
</table>

**An Industry insulated from Market forces**

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### Evolution of India’s Regulatory Environment...

<table>
<thead>
<tr>
<th>1991 onwards : Economic Liberalisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Steel Sector opened to private participation</td>
</tr>
<tr>
<td>- Included in list of “High Priority” industries</td>
</tr>
<tr>
<td>- Up to 100% FDI allowed in prospecting &amp; mining Iron ore</td>
</tr>
<tr>
<td>- No separate approval for prospecting and mining necessary</td>
</tr>
<tr>
<td>- Decanalisation of low grade Iron Ore (Fe&lt;64%) trade.</td>
</tr>
<tr>
<td>- Decanalisation of high grade Iron Ore (Fe&gt;64%) - Export License given for limited quantity and time.</td>
</tr>
</tbody>
</table>
### Challenges & Policies for meeting growth demand

**Challenges**
- Fragmented capacities
- Unscientific operations
- Inadequate power & transport infrastructure
- Delay in grant / renewal of mineral leases

**Policy Reforms under consideration**
- Minimum production levels for lease grant
- Scientific Mining and Mineral Beneficiation
- Lease grant solely on the basis of technical & financial capability
- FDI & private sector participation for infrastructure development
- Time bound grant/renewal process

### Challenges & Policies for meeting the growth demand

**Challenges**
- Long drawn process for land/forest/environmental clearance
- Socio/political pressures
- Limited iron ore / coking coal reserves

**Policies reforms under consideration**
- Creation of land bank / private sector participation in afforestation
- Social / Environment cost to be seen in Long Term perspective
- Transparent implementation of the laws
- Technology / private participation for detailed exploration
- Large area prospecting license
- Linking iron ore resources to integrated and other steel plants
- De-nationalization of coal mines
- De-reserving areas for private sector for a level playing field
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Rail Freight in India are high

Railway Distance & Freight of Major Players
Weighted Ave. Rly distance & costs (Iron Ore) - 2002

<table>
<thead>
<tr>
<th>Country</th>
<th>Transport Cost</th>
<th>Rail Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>3.03</td>
<td>315</td>
</tr>
<tr>
<td>Brazil</td>
<td>3.5</td>
<td>650</td>
</tr>
<tr>
<td>S.Africa</td>
<td>5.87</td>
<td>847</td>
</tr>
<tr>
<td>India</td>
<td>8.11</td>
<td>477</td>
</tr>
</tbody>
</table>

Transport Cost
Rail Distance
Inland Transportation of Raw Material

<table>
<thead>
<tr>
<th>Traffic in steel sector (mt)</th>
<th>Railway</th>
<th>Road</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Material</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finished Steel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raw Material</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finished Steel</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Inland transportation:**

- Infrastructure being beefed up for the incremental volumes


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**Railways – The challenges**

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Initiatives …</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Tariff &amp; Capacity out of sync with a high growth environment</td>
<td>• Expansion of facilities</td>
</tr>
<tr>
<td>• Operational efficiencies.</td>
<td>• Development of raw material corridor for faster movement of raw materials to ports and consumption points</td>
</tr>
<tr>
<td>• Costlier longer hauls</td>
<td>• Improving services</td>
</tr>
<tr>
<td>• Lower bulk movement per haul</td>
<td>• Reinforcing existing tracks</td>
</tr>
<tr>
<td></td>
<td>• Improvement in freight structure</td>
</tr>
<tr>
<td></td>
<td>• Participation of private sector through SPV / own your wagon</td>
</tr>
</tbody>
</table>
The port facilities would also have to be expanded substantially. Improving productivity, turn around time, capacity to handle larger vessels and other operational parameters of efficiency are critical. Private sector participation in ports increasing. Feeder balance (mainly railways) is a key issue.
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India – A Land Of Opportunities

- Fourth largest Economy (PPP) - A safe place to do business
- Largest reservoir of skilled/semi-skilled manpower at low cost
- Long-term sustainable Competitive advantage - High growth rate economy
- Developing Infrastructure
- Rich Mineral Base
- Largest democracy – political stability & consensus on reforms
- Liberal & transparent investment policies
- High returns on investment
- Regulatory Reforms